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MOLLUSCA.

TESTACELLIDÆ AND ZONITIDÆ.

BY

THE LATE DR. W. T. BLANFORD, F.R.S.,

AND

LT.-COL. H. H. GODWIN-AUSTEN, F.R.S.

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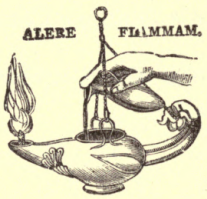

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PREFACE.

THE present short volume of the 'Fauna of British India' series deals with the families Testacellidæ and Zonitidæ of the Indian Land-Mollusca. This account of these two important families of land-shells is founded on the all too short manuscript left by the late Dr. Blanford, who in it had dealt with the shells chiefly from the conchological side. It was fortunate therefore that Lt.-Col. Godwin-Austen, whose unique knowledge of Indian Mollusca is well known to students of the Indian Fauna, willingly consented to take up and complete the malacological part required for the volume. This, however, necessitated a re-arrangement of the MS. and a considerable amount of further study and dissections, all of which retarded the publication of the work.

C. T. BINGHAM.

London,
June 1908.

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* [Footnote p. xiii applies to the next four genera.]

INTRODUCTION.

By the death of Dr. W. T. Blanford, the late talented Editor of the 'Fauna of British India' series, the writing of the Introduction to this volume has devolved on me.

Up to a few days of his death, 23rd June, 1905, Blanford was engaged on this the first volume on the Indian Mollusca, and it was with bitter regret he feared he could scarcely be spared to complete it. It saddens me now to think that, perhaps, had I been able to go up to town oftener in those days and help, the work might have progressed faster, but I could not neglect duties in the country.

On commencing the work, now some years ago, Blanford asked me if I would assist him in the malacological part while he undertook the conchological. With regard to the latter, I may safely say there was then no man living who knew the Indian Land-Shells and their distribution better than Dr. Blanford, to which he added an intimate knowledge of the external form of the animal. In a Field Note-book of his I have found many valuable drawings and descriptions made from life and have used some in this work. In going over his manuscript I could not but see what long and laborious work it had entailed with the constant use of the microscope as the fresh descriptions of the shells were written.

Since 1877 I have been constantly at work on the internal anatomy of the Indian land-shells, having brought home a large collection preserved in spirits. To gain some further knowledge, particularly of the range of genera, I examined all the material I could obtain from Borneo and the Malay Archipelago, the Mascarene Islands, Socotra, and Africa. The results of this have been published from time to time. Many species obtained by Blanford during the last two or three years of his life he placed in my hands for examination, so that the generic position of a large number of forms is now very fairly arrived at.

It is a great loss to science that Blanford did not live to put together his full and matured ideas on distribution, phylogeny, &c. He was eminently fitted to do this by his extensive knowledge of the country, his powers of observation, and his studies in other branches of the animal kingdom. I, who really took up the collection and study of land-shells at his instigation and owe much that I have learnt to him, feel far from equal to the task.

With regard to the shells merely, there is very little more to be made known, but a reclassification of the family Zonitidæ, based upon all the characters of the animal and the shell combined, is very desirable. There is so much to be done that it seems even now somewhat premature to bring out this volume, the more so as it deals principally with the above-mentioned family and because our knowledge of the Pulmonata (the Land-Mollusca of India) is far behind our knowledge of any other group among the Invertebrata. This is due to the fact that until comparatively recently the shell only, and not the animal that constructs it, has been taken into consideration. It is well known that the building up of the shell is a process performed invariably in the same way by one part of the animal.

These neglected forms of life are found by those who will examine them to differ, generically speaking, widely one from the other. It will be seen in the following pages that a very large number of them have never been examined at all, so that it is still doubtful to what genus many of them should be assigned. Any satisfactory conclusion therefore regarding their phylogeny is impossible and regarding their distribution most uncertain. In examining the shells alone we find in several genera these are so extremely alike, the differences so subtle that the eye fails to appreciate them. Again, the uncertainty regarding habitat is increased in some cases by the types being lost; in others by the doubtful authenticity as to habitat of their representatives in museums. Occasionally three different species may be found in one tablet under the same name, and these from two or more localities. In such cases it is only by collecting *de novo* in the localities where the types were procured that we can be certain of absolute and true identification.

Only the families Testacellidæ and Zonitidæ are included in this volume.

The classification adopted has been that employed in the manuscript left by Dr. W. T. Blanford, which was the subject of many conversations and constant correspondence with him. I conclude he based it upon the classification used by Paul Fischer in his 'Manuel de Conchyliologie' (1887), one which has to some extent been adopted in the arrangement of the molluscan collections at the Natural History branch of the British Museum. With regard to the different genera Dr. Blanford had worked through, the order in which some had to be placed had yet to be decided; the last morning's work we did together when he was staying with me at Nore, 7th May, 1905, had reference to this very point.

I have given very considerable thought to this question of classification and adopted a sequence which is as natural, I trust, as our limited knowledge of the animals at the present time will permit and as consonant as I can now make it with Blanford's views.

Blanford left the descriptions of three new genera, and I have

thought fit to create three more, for the reception of certain species which had points in their anatomy differentiating them from the species with which they had been placed.

In that very specialized division of the animal kingdom, the Land-Mollusca, and particularly in the family Zonitidæ, great uniformity of the general main structure obtains with at the same time very remarkable variation of the several parts, particularly those of mastication and generation; it may be safely said that in some genera a greater amount of variation is met with in the internal organs than is to be found in the form of the shell. When we come to compare molluscous animals from far distant parts of the world, either proceeding from east to west, or from the Northern to the Southern Hemisphere, we find each land-area has its own distinctive set of genera. Fossil evidence again shows some have had in the past a much more extended range, and it becomes evident they have gone through a remote, extremely slow, and separate evolution. This is, after all, not so remarkable when the great antiquity of the Pulmonate Mollusca is considered: land-shells extremely like those of the present day go back to the Palæozoic period, being first known from the Devonian, and together with other life on the earth demand many subsequent eras for their specialization.

While the Vertebrates have been classified scientifically by their internal anatomy, Invertebrates such as the Mollusca have received comparatively desultory notice. For this reason Dr. Blanford in arranging for the publication of a volume on the Land-Mollusca decided to incorporate all that was known of the animal.

Many years must elapse before the necessary material can be got together to elucidate and advance the knowledge of the generic relationship of these Indian land-shells. In the case of the Zonitidæ, it happens a large number of very fragile shells are found differing very slightly from each other in shell-character, yet on examination of the animal such marked differences are presented that they have to be placed in separate genera; in fact satisfactory determination is quite uncertain without a knowledge of the animal.

Space will not admit of dealing with the anatomy in any great detail; I have therefore only attempted so much as seems desirable to give the collector some idea of the position and function of the different parts, from which he will more readily understand that the shell alone is of very uncertain value in all questions relating to phylogeny or relationship, evolution, and range in connection with problems relating to the former distribution of land and sea.

Body and Foot.

Animal soft and flexible, covered with an epidermis which in the land forms secretes much mucus from an elaborate system of not only mucous, but sensory and pigmentary glands, rendering

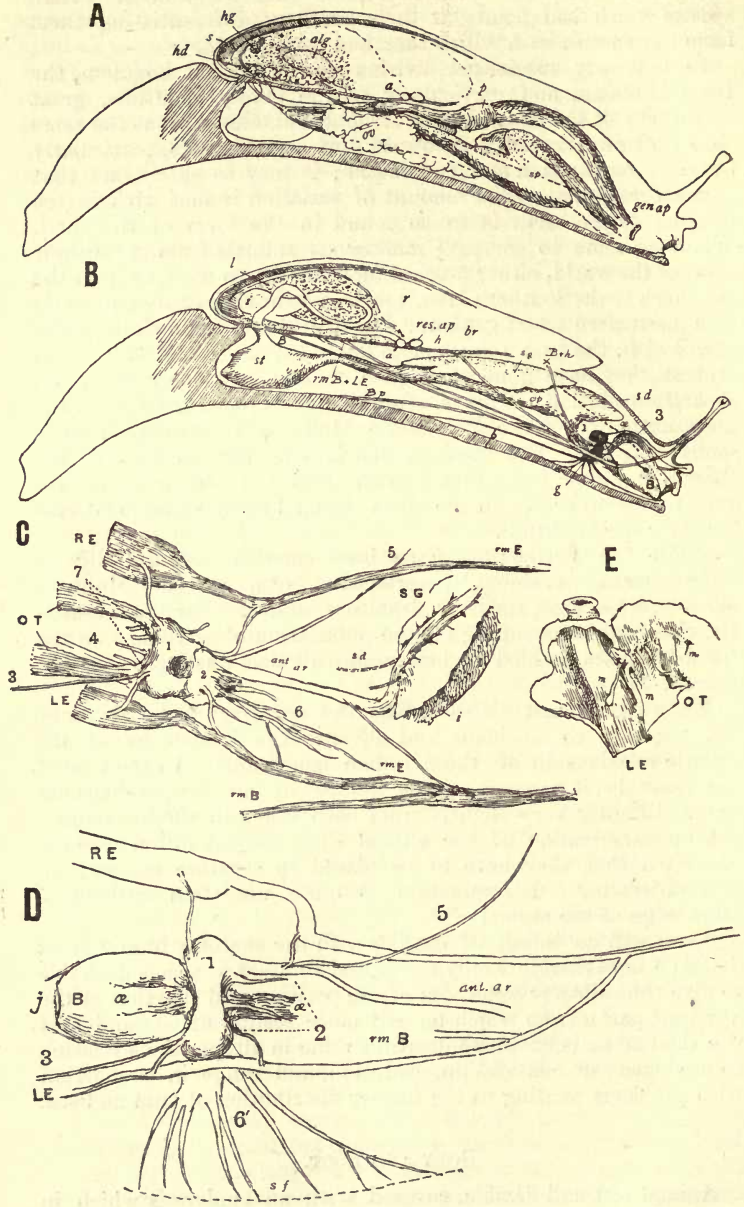

Fig. i.—*Girasia hookeri.* Silchar, Cachar.

the surface moist and acutely sensitive to touch and smell. There is no internal bony skeleton assisting in the movements of the animal; all action is produced by a beautiful contractile and protrusive muscular system, one part as it were pulling against and acting on the other.

In the Mollusca the primitive plan of structure was a body symmetrical to a median vertical plane, the alimentary canal running from the mouth at one end to the anal aperture at the other. This body had a lower ventral or neural face, an upper dorsal or hæmal face, and a right and left side. Only in a few of the Mollusca has this symmetry of the body been retained undisturbed, as in the very ancient classes Amphineura, Scaphopoda, and Pelecypoda, and the hæmal face is not produced into a visceral sac; but in the great majority of mollusks such a visceral sac is found. In the Gasteropoda the ventral face gives rise to a muscular foot. The structure of this foot is important; it shows considerable modification, which renders it of much value in classification, according as it has been modified for digging, swimming, or creeping as in the land forms.

The dorsal face is generally produced at its margin into a free fold, called the mantle or pallium, derived from the primitive

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Explanation of Fig. i.

A. Diagrammatic view of right side, to show the position of the generative organs within the body-cavity and that of the rudimentary shell. About nat. size.

B. Similar view, to show the position of the nervous ganglia and a few of the nerves radiating from it; also to show the general plan of the muscular system, a few of the main muscles at the position of their attachment points, the buccal mass and alimentary system with the salivary glands, and the position of the branchial chamber and pericardium. About nat. size.

C. The cerebral and pedal ganglia with some of the various nerves, together with the main muscles of the buccal mass and eye-tentacles. Viewed from above, laid out. Drawn under microscope. × 4·5.

D. The same, drawn by eye, showing the nerves to middle of the foot (6′) and position of the buccal mass and œsophagus. Viewed from above.

E. The left eye-tentacle and oral tentacle, severed from the part in C. Viewed from the inside, showing the small retractor basal muscles (*m*).

R E. Right eye-tentacle.
L E. Left eye-tentacle.
O T. Oral tentacles.
S G. Salivary glands.
sd. Salivary ducts.
rm E. Retractor muscles of eye-tentacles.
rm B. Do. of buccal mass.
r. Renal organs.
i. Intestine covered by salivary gland.
j. Jaw.
h. Heart.
ant.ar. Anterior artery.
sf. Side of foot.
B. Buccal mass.
œ. Œsophagus.
m. Muscles.
1. Cerebral ganglia.
2. Pedal ganglia.
3. Nerve to base of left eye-tentacle.
4. Nerves to lips.
5. Do. to posterior right side of foot.
6, 6′. Do. to basal edge of foot.
7. The position of the otocysts.

shell-gland, the edges of which secrete and form the shell. Between the mantle and the rest of the body is a cavity, the pallial chamber, the seat of the respiratory organs, which may consist of gills (*branchiæ*), or, as in the Pulmonates, of a sort of lung formed by a network of blood-vessels developed on the roof. The pallial margin forms a complete zone with only a small aperture for respiratory and excretory purposes, and thus the mantle becomes divided into lobes, an anterior left and a posterior right, the dorsal lobes being below them.

Gasteropods with conical or spiral shells, with gills placed in front of the heart, and sexes distinct—that is to say, nearly all the marine and a large series of terrestrial genera—belong to the order Prosobranchia.

In the Pulmonata, with which this volume deals, the mantle is large as well as the unsymmetrically coiled visceral sac, in which the intestines, liver, and part of the genital organs lie. The mantle-cavity lies on the fore part of the sac, and the anus (*a*) opens at its margin, generally on the right side. Thus in all the ordinary Pulmonata the end of the intestine is twisted from its primitive position at the hinder end forwards to the right dorsal side of the body.

In the cephalic area all the organs of sense are situated, the common generative aperture lying on the right side at a varying distance behind the right eye-tentacle. The head or prosoma is symmetrical, bearing on the upper side two cylindrical, tapering, hollow, reversible tentacles, with swollen or bulbous tips carrying the eyes, also two much shorter below them, the oral; both pairs are contractile within the body-cavity. On the anterior ventral side is the mouth, with the more or less solid jaw above and visible externally. The radula with its teeth below is not usually seen unless when protruded. The mouth is quite distinct from the respiratory system and is used for feeding only. The upper lip has a ring of rounded tubercles on its edge; the lower lip is simpler and more fleshy, but in certain carnivorous forms the corners are produced into lappets.

The pedal area consists of the muscular foot or podium, and is characteristic of the Land-Mollusca and all Gasteropods. It varies greatly in size and form in different genera. When fully extended the portion behind with respect to the shell or visceral sac may be very short, that in front very long, or they may be equal in length. It may be either narrow or broad and flat, almost circular, possessing thus great power of adhesion to the surface on which the animal rests. The foot-sole in the Cyclostomidæ is divided longitudinally into two portions, and the animal crawls by advancing the halves alternately. The sole has either a smooth uniform surface or it is divided into three nearly equal parts (trifasciate) longitudinally, the central area being the true ambulatory one. This is the type generally found in genera of the Zonitidæ, and has as well, on the outer side of the foot, a border broken up into segments by lines giving it a fringed appearance.

Above this are the very pronounced parallel peripodial grooves, generally two, in a few cases three, broken into oblong spaces (*vide* fig. 38, A, p. 75). The rest of the body is covered with papillate tubercles or fine rugosities, separated by deep grooves leading from the upper peripodial groove towards the dorsum of the foot. The Zonitidæ also have a conspicuous caudal mucous gland variously formed (fig. 57, C, p. 159). The upper surface of the foot behind may be keeled above, but it is generally rounded.

Even in those genera of the Zonitidæ, such as *Girasia* (fig. i, A, B, p. xx), where the shell has been reduced to a mere membrane, the foot never reaches the true slug-like stage found in *Limax*, *Arion*, &c., in which genera the viscera fill the whole foot to its extreme posterior point, or rather the visceral hump is spread over the whole dorsal surface of the creeping-organ. The foot in the Eastern forms of Zonitidæ is solid in form, and their other anatomical details present so great a similarity to the component parts in the shell-bearing genera from which they have descended, that they furnish closer links in a chain of evolution than is often to be met with.

The Muscular System.

The greater mass of the body is a network of muscular tissue most perfect and complicated. The larger muscles are very tough, ribbon-like, smooth, and shiny. The largest is the shell-muscle attaching the animal to the shell, and most of the stronger most important muscles are given off from it. In those species where there is only a remnant of a shell and no columella the attachments of the principal muscles lie around the thickened mantle-edge, principally on the posterior margin; these include the buccal retractor and the retractors of the foot and eye-tentacles (fig. i, B, C). Some 4 or 5 fine muscles lead from the sides of the mouth and pass through the nervous collar in a posterior direction. There is a localized series in the buccal mass known as the depressor, protractor, and levator muscles.

The Nervous System.

The main mass of the nervous system is situated just behind the buccal mass (fig. 2, *b*, p. 3) and mouth, forming a ring or collar (*cg*) (fig. 4, *ng*, p. 4), through which the alimentary canal passes posteriorly. It is made up of paired ganglia, more or less united by commissural bands completing the collar. According to their position above or below the œsophagus (*œ*), they have been termed the cerebral or supra-œsophageal; the pedal with the visceral or parieto-splanchnic, sub-œsophageal. Taking the genus *Girasia* to exemplify the nervous system in the Zonitidæ (fig. i, C, D), these ganglia are all, as it were, coalesced together, and the side connectives are not seen. The several nerves leading from the upper or dorsal side of the mass define the cerebral

position, while those below show by the direction they take the pedal and visceral parts of the ganglionic mass. From the cerebral parts nerves lead to the eye and oral tentacles and to the sides of the mouth—one (large) to the side of the buccal mass and another (smaller) to where the salivary ducts are given off from it. From the pedal ganglia numerous nerves, some very minute, lead to the sides of the foot, distributed along its edge; one, conspicuous and long, extends to the edge of the mantle on the right side. Some of these nerves bifurcate before reaching the foot. These visceral nerves thus break up and extend all over the body of the animal along the course of the alimentary canal and the generative organs, &c. Land-Mollusca possess sensory organs, and their sense of touch and smell is acute, both combined directing them in their search for food and hiding-places. The seat of the olfactory organs is the apex of the tentacles, more particularly the dorsal pair, but the ciliated surfaces of the body round the mouth and respiratory aperture assist in the sense of smell.

Two auditory sacs (otocysts) are usually found situated on the anterior side of the cerebral ganglia. They are lined with cilia and contain minute calcareous particles, called otoconia, of varied forms in different genera and species.

Alimentary System.

The alimentary canal is very long, extending back in a loop within the apical whorls of the shell and returning forward to the side of the respiratory orifice (fig. i, B). In different genera there is considerable difference and complexity in the way in which it is coiled. The fore portion, called the fore gut, includes the buccal cavity. The narrow œsophagus or gullet leaves this on the dorsal side, passes through the nervous collar, and expands into the crop. Spread upon this are the salivary glands (fig. 2, *sg*, p. 3), generally paired but sometimes coalesced together; fine ducts, one on either side, called the salivary ducts, connect them with the buccal cavity (*b*). The fore gut contracts and again enlarges into the mid gut or stomach (*st*), and here a duct connecting it with the anterior (*al*) and posterior lobes of the liver occurs, and at about midway in its length the coils of the intestine buried in the posterior lobes (*pl*) return again and continue in a long straight portion of the rectum to the anus (*a*), which in shell-bearing forms is near the upper and inner angle of the aperture or near the junction of the right and left dorsal lobes; in the more slug-like forms (*Austenia* and *Girasia*) it is on the side of the body. Where the shell has become reduced, as in these two Indian genera of the Zonitidæ, the viscera never occupy the foot to its terminal end, as is seen in *Limax* and other Palæarctic genera.

The Buccal Mass.

This lies between the nervous ring and the mouth, is a large globose muscular sac, on its exterior sides having a wonderful system of powerful muscles leading to different parts of the

animal, principally to the shell-muscle, by which the animal can move it in every direction, protrusive or otherwise. These muscles have been termed the anterior, lateral protractors, and pharyngeal or buccal retractors.

Odontophore and Jaw.

Just within the circle of the mouth is the buccal cavity, and on the upper anterior side is the solid chitinous jaw set in the strong mandibular muscles. In the genera treated of in this work there are only a few in which the jaw is absent; in those possessing it, it is sometimes solid, sometimes thin and of oxygnathous type, *i. e.* with a sharp cutting-edge. The jaw serves to press down upon, hold, or even cut off what the animal may feed upon. Within the buccal cavity on the lower side is a cartilaginous globose cushion on the floor of the mouth, the odontophore; its upper surface is covered with a tough, long, ribbon-like membrane, set with rows of minute, recurved, chitinous teeth, extending backward to the radular sac. In this last the teeth are formed and pass gradually forward as the rows in front become worn away. These teeth help, with the edge of the jaw above and the action of the lingual protractors and retractors, to the rasping off and breaking up of food. The surface of the radula can be folded together, as in the state of rest, or spread out laterally over a plane surface. The odontophore is developed early in life in some ovoviviparous forms; the radula is found complete in the embryo enclosed in the eggs lying in the oviduct.

The teeth of the radula are arranged in rows, generally about a hundred—the rows either nearly straight or forming with the central tooth at the apex an obtuse angle. The central tooth and its neighbouring admedians are usually set upon thin, broad, quadrate plates, which merge gradually into lateral teeth rising from much narrower plates. The cutting-tooth is sharp-pointed and raised well above the basal plate, the whole series forming a most perfect natural file.

In carnivorous genera the teeth are aculeate or scimitar-shaped, rising from elongately ovate bases.

Perhaps one of the most interesting morphological characters to be noticed in the radula of these Eastern slug-like mollusks, comprising even some with *Helicarion*-like shells, is the existence of two very distinct groups or subfamilies, one with a *Macrochlamys*-like radula, the other with a very different polydont one of several hundred teeth, all similar in form throughout on very narrow basal plates, and rarely having any large admedian, though a few intermediate forms occur.

Organ of Respiration.

The respiratory orifice is distinctly seen on the right side of the body, lying in a dextral shell near the upper inner angle of the aperture, in a slug-like mollusk it is on the right side, in both

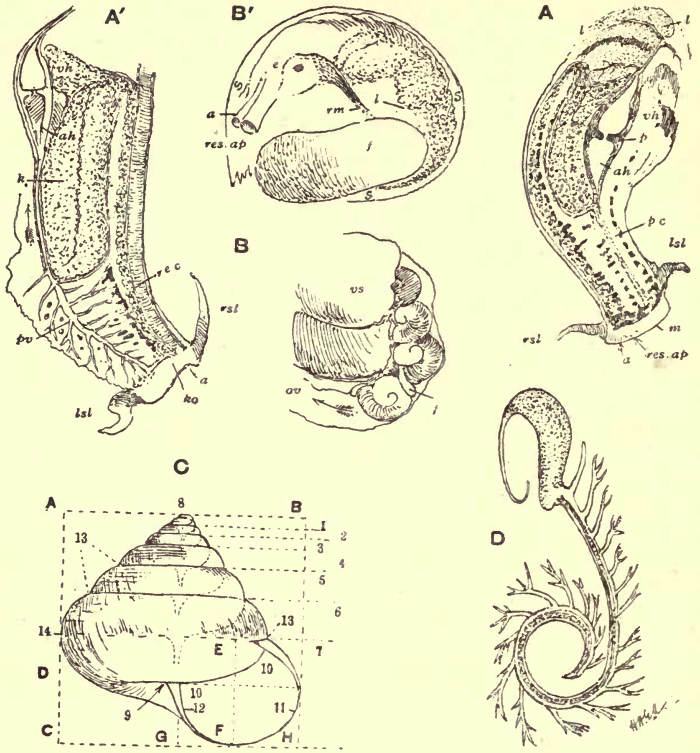


Fig. ii.

A. *Sakiella honesta*, enlarged. Dorsal side, viewed from above, to show position of the pericardium (*p*), heart with auricle (*ah*) and ventricle (*vh*), kidney (*k*), pulmonary cavity (*pc*), liver (*l*), anus (*a*), mantle-edge (*m*).

A′. Dorsal side, seen from below. Rectum (*rec*), kidney-opening (*ko*), pulmonary vein (*pv*), right shell-lobe (*rsl*), left shell-lobe (*lsl*).

B. *Microcystis ambæ*, showing embryonic shells within the oviduct. × 9.

B′. An embryonic shell, showing development of the foot, with eye and anal and respiratory orifices. × 44.

C. Shell of *Sitala attegia*. Diagram to illustrate the different parts and usual measurements.

D. A spermatophore of *Sesara infrendens*, much enlarged. After Stoliczka.

Parts of the shell and usual measurements.

1–7. The apical whorl to the 7th (the last or body-whorl).
5. The antepenultimate whorl.
6. The penultimate whorl.
8. The apex.
9. The umbilical region.
8–9. The axis. 8–14. Spire.
10. The aperture: the upper, outer, and inner angles of, the interval between being the wall of the aperture.
11. The peristome and outer lip.
12. The columellar margin.
13. The suture.
14. The periphery or keel.
A–B. Major diameter.
A–C. Height of shell.
A–D. Do. of axis.
E–F. Do. of aperture.
G–H. Breadth of aperture.

near where the dorsal lobes meet. The pulmonary chamber or cavity lies beneath the shell on the left side just behind the upper margin of the peristome and continues back for some distance, its general shape and size presenting variation in different genera. The upper surface is an extremely transparent thin wall, showing, in most species, a system of small veins uniting in a main pulmonary vein (*pv*) and forming a respiratory surface by which they breathe air directly. On the posterior left side of the pulmonary chamber is the pericardium (fig. ii, A, *p*).

Heart and Circulatory System.

The pericardium (fig. ii, A, *p*) is a sac lying on the left anterior side of the body in dextral shells, adjacent to the branchial cavity and close against the renal organ (*k*), all these lying on the dorsal surface of the body. Within it is the heart, composed of a single auricle (*ah*) and a single ventricle (*vh*): the first receives the blood from the respiratory organs, which passes by a short constricted valvular passage to the second. A short duct, the aortic trunk, follows: it branches into two separate veins, the anterior and posterior aorta, conveying the generally colourless blood to the various organs of the body. Thence it collects in the venous sinuses in the foot and viscera and the circumference of the body before entering the respiratory (*pv*) and renal organs (*k*). In the former of these oxidation takes place and the blood returns to the heart again by the pulmonary vein (*pv*). In the renal organ waste products in the blood are taken up, which are thrown out by way of a narrow passage (*ko*) lying parallel to the rectum and so on to the anus (*a*).

Reproductive Organs.

The generative orifice is situated close behind the right eye-tentacle (fig. i, A, p. xx). The animal is hermaphrodits or monœcious, the male and female systems being brought together in one individual, and the animals unite for mutual fecundation. The source of the system lies far back in the visceral sac (fig. i, A), where buried in the posterior lobe of the liver is the ovo-testis (*hg*) (a mass of cells), on the internal surface of which both ova and spermatozoa are produced: the former are rounded cells, the latter long and hair-like, with variously-shaped heads massed together. From the ovo-testis extends a long duct called the hermaphrodite duct (*hd*), usually very much convoluted, and down which the ova and spermatozoa pass. The duct enters the albumen-gland (*alg*), an elongate mass, and just before it does so there is a small enlargement or sharp bending termed the seminal vesicle. The ova here undergo a certain change and are separated from the spermatozoa—the one to pass down the oviduct, the other down the prostate.

The oviduct (*ov*) is of a whitish colour, with large convoluted folds. These two coalesced ducts run side by side for a considerable distance and then separate, the ovo-testis becoming a

stout hollow tube, the free oviduct leading onwards to the genital aperture (*gen.ap*), the prostate or sperm-duct becoming a slender tube, the vas deferens (*vd*) carrying the spermatic contents to the male organ. We have now reached the vicinity of the head and buccal mass. Before the free oviduct reaches the genital aperture it gives off a more or less globose or pear-shaped sac, varying much in size; this is the spermatheca (*sp*). It receives, when the animals are *in coitu*, the spermatophore, which issues from the male organ of the other individual. The male organ (*p*) consists of a muscular reversible sheath or tube extending a short distance from the genital aperture backwards, and gives off, generally where it doubles back, a strong muscle called the retractor penis muscle. The next part contracts into a smaller length of tube, the epiphallus, to which the vas deferens joins after this latter has formed a loop forward and close up to the genital aperture. At the junction of the vas deferens and the epiphallus is usually a cæcum-like appendage, the kalc-sac, or flagellum when more whip-like. Within this the spermatophore is formed. Yet another organ, not universally present, remains to complete this complicated system, viz. the amatorial organ or dart-sac (*am.or*). It is usually tough and muscular, cylindrical in form, with a retractor muscle at the distal end; within it is a pointed style, which is protrusive at the genital orifice. This is analogous to the calcareous dart of the Helicidæ. The male organ and adjacent parts is reversible and protruded externally during copulation.

The spermatophore (fig. ii, D) is a complex structure built up or moulded within the walls of the flagellum during the period of generative activity. It consists of two distinct parts—one long and gutter-like, generally spined; the other a thin-walled cylindrical sac in which the spermatozoa passing down the vas deferens collect and are retained until transplanted into the sperm-sac of another individual to fructify its ova. The spermatophore takes on many various forms in different genera and is as yet quite unknown in the great majority of the Land-Mollusca; it would appear to be secreted rapidly and its remains broken up are soon absorbed and disappear.

The eggs when laid hatch out naturally by the warmth of the atmosphere, but in some genera an ovoviviparous habit has come about, and the eggs are retained in the oviduct (fig. ii, p. xxvi, B, & fig. 2, p. 3) and go through the early stage of development there, so that the young have well-formed shells and are able to crawl about and feed themselves as soon as they are born.

The shell makes its appearance is very early embryonic life, in the form of a little rounded inverted cup or bowl, and as the infolded viscera begin their spiral growth it is built up on the free outer edge (the peristome). It is deposited by the edge of the mantle in different layers, the external either horny or membranaceous; in many cases it is very hard, glassy, and polished. In ovoviviparous genera mentioned above, where the shell attains

a development of two whorls or so, the subsequent shell-growth after birth is well marked by its different texture; the first whorls are generally smoother and are distinguished as the protoconch.

It is seen that the organs of generation in these creatures are very complicated and present great variation, not only shown in different genera, but even in detail in different species of the same genus. It is only to be expected that the more complicated an organ becomes, and the greater the number of its component parts, the play and possibility of variation in those parts increases in proportion. This diversity of structure is rendered still more difficult to observe, owing to the great changes that take place in the reproductive organs as the pairing-season approaches, also artificially by the means adopted to preserve the animal. If, for instance, it is put into too strong spirit, great shrinking and hardening ensues, and the parts assume a shape and size very unlike their appearance in life. All this must be allowed for in descriptions. Perhaps too much has already been written on the form of such an organ as the spermatheca or sperm-sac, sometimes empty, at other times distended with one or more spermatophores.

The Mollusca form a very distinct and highly organized division of the Invertebrates. They were very early inhabitants of the globe; their remains are found in the oldest stratified rocks, their shells often most beautifully preserved. It is the knowledge of the animals of their living representatives which gives us an insight into the conditions under which the different formations were deposited. It is remarkable to note how highly organized they were so far back in time and how little has been the change since then, scarcely more than generic.

Marine forms are more abundantly represented, and naturally so, than the land and freshwater. Probably the earliest freshwater form is the *Archanodon*, which closely resembles the modern *Anodonta* (Swan Mussel) and occurs as far back as the Devonian. At the close of the same epoch the first land-snails, *Strophites* and *Dendropupa*, allied to the Chrysalis Shells (Pupidæ), have been found in the Plant-beds at St. John, New Brunswick. The Coal-Measures of the succeeding Carboniferous period have yielded further species of *Dendropupa*, a small land-shell (formerly referred to *Zonites*) closely allied to the living *Pyramidula* if not identical with that genus. Also from the same beds come the oldest brackish-water snail and freshwater snail belonging to the existing genera *Ampullaria* and *Physa* respectively, as well as the first representative (*Zaptychus*) of the Auriculidæ (the most primitive of the Pulmonates), and *Dawsonella* the earliest example of the terrestrial Helicindæ. Other freshwater mussels (*Unio*) appeared in the Trias, but the greater number of freshwater snails are first known from the Jurassic: *Planorbis*, *Valvata*, *Melania* (doubtfully from

the older, but certainly from the later beds of that epoch), with *Limnæa*, *Vivipara*, and others.

In India the Cretaceous rocks of the South Peninsular area are the oldest in which land-shells have been found, and one species was identified by Ferd. Stoliczka as being closely related to the existing Ceylonese genus *Corilla*. Further close search in these beds will probably result in the discovery of other species and they would be of extreme interest.

The Intertrappean beds of Southern India contain several freshwater genera, and a doubtful *Pupa* is recorded from the Bombay rocks of that age, and land-shells have been obtained in the Lower Intertrappeans referred to *Achatina*; here, again, further search is wanted, minute forms have probably never been looked for.

Coming down to more recent times, the species of Mollusca which have been found in the Sewalik formation are similar to those now living: only one land-shell, *Pupa* (*Cylindrus*) *insularis*, a species with a range from India to Africa, has hitherto been found; others are freshwater forms belonging to *Paludina*, *Melania*, *Ampullaria*, and *Unio*. My own experience of the beds in which these fossils occur points to the possibility of much more coming to light when they are worked in the careful manner similar beds have been in this country and in Europe.

From the later Tertiaries of the Kashmir Valley (Karewah deposits) species of *Planorbis* and a *Helix* (?) occur, but those found by me were all flatteued by subsequent pressure the beds had undergone: this formation, which is extensive, would reward further search.

It must be remembered by those who may use this work that the material on which many of the anatomical details here given have been drawn up has been very scanty, and frequently founded on but a single badly preserved specimen, such, for example, as the dried-up animal found within the shell and soaked out; for in most cases the possibility of obtaining additional specimens from very inaccessible parts of India was remote in the extreme.

With regard to the conchological side, the descriptions of the genera and species have been drawn up and all measurements taken afresh by Dr. Blanford, in most cases from types or from typical specimens. The descriptions of the anatomy have been abridged and the figures taken from those given by Dr. Ferdinand Stoliczka in the 'Journal of the Asiatic Society of Bengal,' and those by me in the 'Land and Freshwater Mollusca of India,' and in other papers contributed to various Scientific Societies. The distribution, habits, &c. have been taken from the writings of W. H. Benson, T. Hutton, F. Stoliczka, H. F. & W. T. Blanford, W. Theobald, G. Nevill, E. Sykes, O. Collett, &c., or based on the knowledge of a very large number of species collected by myself.

Though the land-mollusca are not, like birds, butterflies, &c., conspicuous to the ordinary observer, yet they are to be found in

every part of India, even on so parched a rock as Aden. Hence a few words on where and how to collect them may be of service to a naturalist proceeding to the country. These mollusks are by no means easy to find at first, and they are naturally much more numerous in the rainy season, but with patient search they are to be found at other times of the year. On limestone rocks they are sometimes conspicuous by their abundance, old shells litter the ground. In the forest-clad slopes of the mountains, particularly the northern sunless ravines, they are generally plentiful. Owing to the annual burning that takes place, very few are to be found in the great grass-tracts of the plains. Their favourite resorts are under large stones, old logs lying in the woods, under the decaying bark of trees, on the wet lichen-clad bark, on the damp moss near waterfalls, on walls, on the leaves of shrubs, the plantain and bamboos, under decaying leaves, beneath the surface of the ground in the worm-burrows, in the roots of plants, and in the exuviæ left by floods on river-banks many shells are to be found washed off the land. It is a good plan when collecting from shrubs and trees to place an open, inverted umbrella beneath and to beat the shrubs or boughs above, when the specimens dislodged will be caught in the umbrella. In streams and lakes the surface of the water-plants and the decaying stems of reeds and bulrushes should be looked over.

The animal is by no means difficult to dissect, patience and a steady hand are all that is required; to dissect, draw, and mount the radula and other parts will take some hours of work, and a a microscope is indispensable. In the field the preserving, the accurate labelling (which is most important), with necessary notes on external characters, colour, &c., are as much as the collector can undertake.

Some parts of India have been well worked, there are others where nothing has yet been collected. Among the latter I may mention Nepal up to the Kali River; Bhutan east of longitude 89° up to the Dafla Country, eastward again the Miri and Mishmi Hills; south of the Brahmaputra River, the Abor and Singpho Hills; south of Manipur, the Lushai and Tipperah Hills, and the high range, the Chin Hills, southwards. The Shan States have been partially collected in, but there is much to be done in many parts of Eastern Burma. On the North-west Frontier, with the exception of a species of *Petræus*, I have never seen any land-shells from either Swat, Dir, or Chitral. From the Kuram Valley a few species have been received; but since Captain Hutton, in 1842, collected in the neighbourhood of the Bolan Pass, the land-shells of the Suliman Range and hills to the south, lying west of the Indus, have been disregarded.

In conclusion, I must not forget to mention those who have given much valuable assistance to Dr. W. T. Blanford while the work was in preparation and those who have given similar aid to myself: to all sincere thanks are due. Among them I would particularly mention Mr. Edgar A. Smith, I.S.O., in charge

of the Mollusca Department of the British Museum, who was ever ready to place species at our disposal and often added his valuable opinion on the determination or history of the species in hand. The late Professor Alfred Newton and Prof. S. F. Harmer gave every facility for the examination and loan of specimens contained in Benson's typical collection forming part of the McAndrew Collection in the University Museum of Zoology, Cambridge. Colonel R. H. Beddome placed his fine collection and his great knowledge of the Southern Indian land-shells at Dr. Blanford's disposal. I have myself to thank him for many valuable species preserved in spirit. Messrs. John Ponsonby and G. K. Gude's collections have been available for study. I am indebted to Mr. B. B. Woodward for many suggestions relating to molluscan anatomy as well as to their geological ancestry.

Much valuable material, without which the work would have been more incomplete than it is, was received from India collected by Messrs. Edgar Thurston in Madras, the late O. Collett in Ceylon, as well as H. B. Preston; in Southern India and Siam by the late W. M. Daly; in Cachar by F. Ede. The Superintendents of the Indian Museum, Calcutta, Col. A. W. Alcock in the first instance, and more recently Dr. Annandale, have given very valuable aid in collecting and sending home many interesting species properly preserved as well as specimens for comparison. The late Wm. Theobald placed the whole of his valuable collection of spirit-specimens in my hands.

I sincerely trust that the publication of these two Families, which is only a small portion of the Land-Molluscan Fauna of India, will lead naturalists resident in or visiting that country to collect and study this branch of its Natural History: not to be content with collecting the shells alone, but to bear in mind whenever they find the living animal to preserve it and send it, should they not require it for their own examination, to the Indian Museum in Calcutta or to the British Museum at home, where sooner or later it will be available for the investigation of Malacologists.

H. H. GODWIN-AUSTEN.

Nore, July 1908.

ERRATUM.

Page 25, fig. 16, *Ariophanta lævipes*: transpose letters C and D.

[MOLLUSCA.

Class GASTEROPODA.

Order PULMONATA.

Suborder *GEOPHILA* or *STYLOMATOPHORA*.

Group AGNATHA.

Family TESTACELLIDÆ.

Subfamily STREPTAXINÆ.] *

Animal carnivorous, slug-like or snail-like; a shell generally present, but varying much in form. No jaw (hence the group is often distinguished as *Agnatha*). Radula with numerous rows of long, narrow teeth, usually pointed.

Distribution. Temperate and tropical regions of the world.

The majority of the genera are African or South American. Two are Indian, both shell-bearing.

Synopsis of Genera.

Shell heliciform, last whorl excentric ..... STREPTAXIS, p. 1.
Shell pupiform ..... ENNEA, p. 16.

Genus **STREPTAXIS.**

Streptaxis, *Gray, Loudon's Mag. N. H.* new ser. i, 1837, p. 485; *Stol. J. A. S. B.* xl, 1871, p. 159 (anatomy).

Type, *S. nobilis*, Gray, from Sierra Leone.

Range. South-eastern Asia and a few of the islands; Mascarene Islands; Tropical Africa and South America. Found in the Indian Peninsula to the southward only, in Ceylon, [Andaman and Nicobar Islands,] Assam, and Burma, but not in the Himalayas except east of Bhutan.

Fig. 1.—*Streptaxis pfeifferi*. ½. (After Stoliczka.)

Shell thin hyaline, or thicker alabastrine, heliciform, the last whorl or last two whorls excentric, diverging from the axis of the upper whorls.

* In this volume the additions to the MS. as left by Dr. W. T. Blanford have been made by Lt.-Col. H. H. Godwin-Austen and are placed between brackets.

Animal, as in other members of the family, with the anterior portion of the body, or neck, much longer than the posterior portion, or tail, which is very short. The colour is bright yellow, often becoming scarlet on the eye-pedicels and upper portion of the head. Upper tentacles or eye-pedicels elongate, lower tentacles short. Genital orifice on the right side, near the respiratory orifice and at a considerable distance from the tentacle.

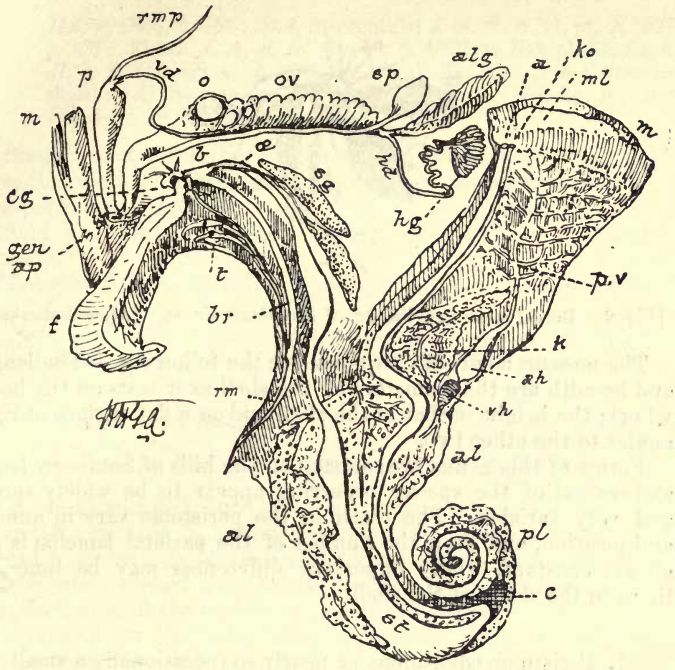
[The description of the internal anatomy is taken from Ferd. Stoliczka's paper on the genus :—

In the main points (*vide* fig. 2) " the organs are quite similarly arranged as in the Helicidæ. . . . . The mantle is above, at the pulmonary orifice, considerably produced, receding ventrally, but remaining entire. On the inner side it has near the margin an elongated, thickened appendage on each side of the pulmonary opening. The pulmonary cavity itself is very long, but the lungs narrow. The digestive system differs from all Helicidæ which I have examined by the peculiar development of the buccal parts. The mouth is wide, and immediately behind it, where it makes an angle, lies the nervous ring. . . . . Immediately behind the nervous ring the buccal parts are produced into a cylindrical muscular tube, which extends in a slight curve up to the end of the chief retractor muscle of the body, where it is firmly attached by a special thick muscle. A few separated threads connect the mouth direct with the anterior end of the retractor. The ring-muscles forming the outer layer of the tube are almost horny, or, at least, very tough. The longitudinal muscles forming the internal layer are much softer, but considerably thicker."

This description recalls the buccal mass of *Testacella* and its powerful muscles. It suggests *Streptaxis* being carnivorous and having a protrusive mouth, enabling it to enter and use the radula within the whorls of other snails. Stoliczka pointed out the similarity of the teeth of the radula to those of *Testacella*. There are other points of similarity, such as the tube-like clusters of the hermaphrodite gland and the form of the male organ (*vide* Proceedings of the Malacological Society of London, vol. i. plate i. figs. 14 & 16).]

Genital organs simple, albuminous gland elongate ; hermaphrodite gland small, composed of a cluster of tubes, the duct long and much twisted. Spermatheca small and globular, with a narrow neck [attached to uterus for nearly the whole length]. Vas deferens very short. Penis short, muscular, the retractor muscle long and thin and attached to the commencement of the penis close to the junction of the vas deferens; no flagellum or kalc-sac. Eggs large and well developed in the oviduct.

Radula long and narrow, composed of numerous rows of simple, almost straight and pointed teeth, [40–60 in row,] each furnished with a small swelling or projection about halfway between the point and the base. The median tooth in each row scarcely differs in form from the lateral teeth. The row is curved into an arc on each side of the middle, with the concavity in front.



[Fig. 2.—Anatomy of *Streptaxis obtusus*. (After Stoliczka.)

a. Anus.
ah. Auricle of heart.
al. Anterior lobe of liver.
alg. Albumen-gland.
b. Buccal mass. See *oe*, fig. 4.
br. Retractor of buccal mass.
c. Cavity where hermaphrodite and albumen gland were originally situated.
cg., *ng*. Cerebral ganglia or nervous ring.
f. Foot.
gen.ap. Generative aperture.
hd. Hermaphrodite duct.
hg. Hermaphrodite gland.
i. Intestine.
k. Kidney or renal organ.
ko. Kidney-opening.
m. Mantle.
ml. Mantle-lobe.
o. Ovum.
œ. Œsophagus.
ov. Oviduct.
p. Penis.
pl. Posterior lobe of liver.
p.v. Pulmonary vein.
rmp. Retractor muscle of penis.
sg. Salivary gland. *dsg*. Duct of.
sp. Spermatheca or receptaculum seminalis.
st. Stomach.
t. Eye-tentacles.
vd. Vas deferens.
vh. Ventricle of heart.

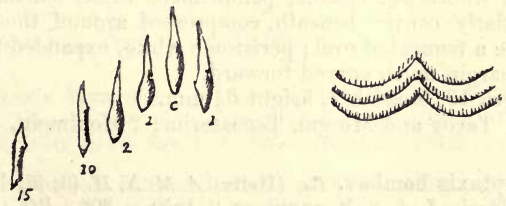
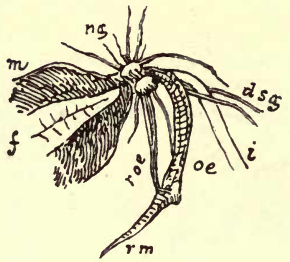


Fig. 3.—Radula of *Streptaxis obtusus*. (After Stoliczka.)]



[Fig. 4.—Buccal mass, ganglia, &c. of *Streptaxis obtusa*. (After Stoliczka.)]

The measurements of *Streptaxis* are the following:—The length and breadth are the diameters of the shell as it rests on the body-whorl; the height is that of the shell laid on a flat surface at right angles to the other two.

Forms of this genus are common on the hills of Southern India, and several of the species occurring appear to be widely spread and very variable. The teeth in the peristome vary in number and position, and even the number of the parietal lamellæ is not always constant, whilst important differences may be found at times in the shape of the shell.

I. Peristome edentulous or nearly so (occasionally a small tubercle inside right margin).

A. *Penultimate whorl rounded or bluntly angulate, not keeled; a single parietal lamella.*

a. *Depressedly ovate; penultimate whorl, seen from beneath, extends half its width beyond body-whorl.*

1. **Streptaxis petiti,** *Gould* (Helix-Streptaxis), *Bost. Jour. N. H.* iv, 1844, p. 456; *Pfr.* (Streptaxis) *Mon. Hel.* i, 1847, p. 8; *id. t. c.* vii, 1876, p. 494; *H. & T. C. I.* 1876, pl. 8, fig. 4; *Nev. Hand-l.* i, 1878, p. 3.

Shell umbilicated, translucent, whitish, finely, closely, and flexuously costulate above, smooth beneath; spire depressedly conoid; whorls $6\frac{1}{2}$, convex, penultimate whorl subangulate, last whorl flatly convex beneath, compressed around the umbilicus; aperture a truncated oval; peristome white, expanded throughout, outer margin much curved forward.

Length 10, breadth 7, height $6\frac{1}{2}$ mm.

Hab. Tavoy and Mergui, Tenasserim; ? Moulmein.

2. **Streptaxis bombax,** *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 186; *Theob. J. A. S. B.* xxviii, pt. 2, 1859, p. 308; *Pfr.* (Helix) *Mon.*

Hel. v, 1868, p. 151; *Stol.* (Streptaxis) *J. A. S. B.* xl, pt. 2, 1871, p. 167; *Theob. J. A. S. B.* xlv, pt. 2, 1876, p. 186, pl. 14, fig. 6; *H. & T.* (Helix) *C. I.* 1876, p. 15, pl. 31, figs. 1, 4 (immature shell); *id.* (Streptaxis) *t. c.* 1876, p. 63, pl. 156, fig. 9; *Nev. Hand-l.* i, 1878, p. 3.

Similar to *S. petiti*, but larger and longer in proportion to the breadth, with the penultimate whorl much deeper and rounded at the periphery; last whorl subangulately compressed at the base behind the peristome, right margin of peristome but slightly arcuate.

Length 15, breadth 9·5, height 8·5 mm.; of a similar form 12, 8, and 7·5 mm.

Hab. Moulmein. Some of the immature specimens originally called *Helix bombax* were from Phietan, Tenasserim.

3. **Streptaxis andamanicus**, *Bs. A. M. N. H.* (3) vi, 1860, p. 192; *Pfr. Mon. Hel.* v, 1868, p. 444; *H. & T. C. I.* 1876, pl. 8, f. 6; *Nev. Hand-l.* i, 1878, p. 2; [*Godwin-Austen, P. Z. S.* 1895, p. 443].

Shell umbilicated, with arcuate costulate striation above, smooth beneath; whorls 5½, convex above, the penultimate rounded; breadth across body-whorl scarcely greater than across penultimate whorl when viewed from below, and last whorl rounded, not compressed, around the umbilicus; aperture a truncated oval, slightly compressed on the outer edge; peristome white, expanded, the outer border arcuate.

Length 8, breadth 5½, height 4 mm.

Hab. Andaman Islands.

4. **Streptaxis blanfordi**, *Theob. J. A. S. B.* xxxiii, 1864, p. 245; *Nev. Hand-l.* i, 1878, p. 2 (Arakan & Pegu).

Streptaxis blanfordianus, *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 163, pl. 7 [fig. 8 (Arakan), fig. 9 (Pegu)]; *Pfr. Mon. Hel.* vii, 1876, p. 494.

Streptaxis burmanica, *H. & T.* (*nec Blanford*) *C. I.* 1876, pl. 8, fig. 5.

[Streptaxis blanfordi, var., *Godwin-Austen, P. Z. S.* 1895, p. 443.]

Very near *S. andamanicus*, but rather more narrowly umbilicated, slightly compressed around the umbilicus, and usually with a distinct tubercle inside the outer border of the peristome, the outer margin of which is less arcuate.

Length 7½, breadth 5, height scarcely 4 mm.

This appears to be merely a variety of *S. andamanicus*.

Hab. Arrakan, Pegu, Shan States; Cocos Islands.

5. **Streptaxis layardianus**, *Bs. A. M. N. H.* (2) xii, 1853, p. 90; *Pfr. Mon. Hel.* iv, 1859, p. 332; *id. t. c.* vii, 1876, p. 495; *H. & T. C. I.* 1876, pl. 98, figs. 1, 4; [*Nev. Hand-l.* i, 1878, p. 4].

Shell perforate, subumbilicated, striated, whitish; spire low, convex; whorls 6½, convex above, penultimate rounded, the last

convex, slightly flattened beneath, very little compressed at the base; aperture subtriangularly semi-oval; peristome expanded, deeply sinuate at the angle, the sinus sometimes terminating in a small blunt tubercle on the parietal wall; a single parietal lamella.

Length 9¼, breadth 7, height 5 mm.

Hab. The hills of Southern Ceylon. This passes into *S. cingalensis*, p. 12.

D. *Depressedly ovate; the penultimate whorl, seen from below, just extends beyond body-whorl.*

6. **Streptaxis burmanicus**, *Blf., Theobald, J. A. S. B.* xxxiii, 1864, p. 245, pt.; *Blf. J. A. S. B.* xxxiv, 1865, pp. 81, 105; *Pfr. Mon. Hel.* v, 1868, p. 444; *id. t. c.* vii, 1876, p. 494; *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 113, pl. 7, figs. 5–7.
Streptaxis blanfordi, *H. & T.* (*nec Theobald*) *C. I.* 1876, pl. 8, fig. 10; [*Nev. Hand-l.* i, 1878, p. 2 (Toungoop & Tounghu; small var. Rangoon, *vide Stol. t. c.* pl. 7, figs. 6, 7)].
Streptaxis thebawi, *Godwin-Austen, P. Z. S.* 1888, p. 243.

Shell umbilicated, finely, closely, and flexuously costulate above, smooth beneath, whitish; spire convex; whorls 6–6½, slightly convex above, the penultimate rounded at the periphery; last whorl much broader than the others, slightly flattened beneath,

Fig. 5.—*Streptaxis burmanicus.*

very little compressed around the umbilicus. Aperture semi-oval, parietal lamella well developed; peristome white, expanded, outer border boldly arcuate, and with sometimes a small tubercle or tooth inside opposite the top of the parietal lamella. This tooth is often wanting.

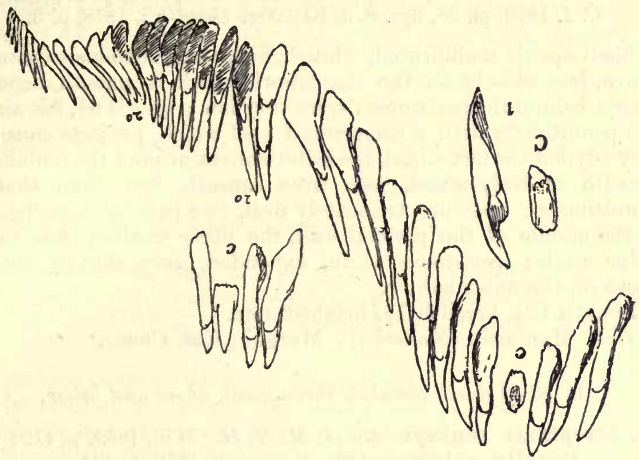
Length 10, breadth 7½, height 6 mm.; of a smaller specimen 7½, 5¾, and 4; of *S. thebawi* 10, 7, and 6.

Hab. Arrakan and Pegu; *S. thebawi* from Pingoung, Shan Hills, Upper Burma.

7. **Streptaxis pfeifferi**, *Zelebor, Verh. zool.-bot. Ges. Wien*, xvii, 1867, p. 806; *Pfr. Mon. Hel.* v, 1868, p. 444; *id. t. c.* vii, 1876, p. 495; *Godwin-Austen, P. Z. S.* 1895, p. 443.
Streptaxis pfeifferianus, *Stol. J. A. S. B.* xl, pt. 2, 1871, pl. 8, fig. 6 (animal); *Nev. Hand-l.* i, 1878, p. 2.
Var. minor, *Mörch, Jour. de Conch.* Oct. 1876, p. 359. Kar Nicobar.
Var. pumilio, *Mörch, t. c.* Oct. 1876, p. 359. Kamorta.

Similar to *S. burmanicus*, but with half a whorl less; the

sculpture above is finer; the base around the umbilicus is rounded, not compressed; the parietal lamella less developed; the mouth more rounded; the peristome on the outer side much less convex, and neither compressed nor tubercular.



[Fig. 6.—*Streptaxis pfeifferi.* × 158 & 296.]

[The radula has the formula 29 . 1 . 29. The centre tooth is smaller than the first and second; in one specimen examined, the centre tooth was quite rudimentary.]

Length 8⅔, breadth 6, height 4½ mm.

Hab. Nicobar Islands; Camorta, Katchall, Kar Nicobar.

c. *Ovately conoid; penultimate whorl completely hidden from beneath by body-whorl, when seen in the direction of the axis of the upper whorls.*

8. **Streptaxis solidulus,** *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 166, pl. 7, fig. 10; *Pfr. Mon. Hel.* vii, 1876, p. 494; *H. & T. C. I.* 1876, pl. 98, fig. 7; *Nev. Hand-l.* i, 1878, p. 3.

Shell moderately umbilicated, whitish, solid, finely and flexuously costulate above, smooth beneath; spire conical; whorls 6½, the upper flatly convex, penultimate rounded at periphery, body-whorl by far the largest and deepest, slightly compressed around the umbilicus; aperture semioval, parietal lamella moderate; peristome expanded throughout, nearly in one plane, outer margin scarcely arcuate.

Length 12, breadth 9, height 7½ mm.

Hab. Near Moulmein, at Yethebiankoo on the Attaran River. Typical locality (*Theobald*).

B. *Penultimate whorl sharply keeled; shell much depressed.*

a. *Base of last whorl smooth and polished.*

9. **Streptaxis exacutus**, *Gould, Proc. Bost. Soc. N. H.* vi, 1856, p. 13; *Pfr. Mon. Hel.* iv, 1859, p. 331; *id. t. c.* vii, 1876, p. 494; *H. & T. C. I.* 1876, pl. 98, figs. 8, 9, 10; *Nev. Hand-l.* i, 1878, p. 3.

Shell openly umbilicated, whitish, finely and flexuously costulate above, less closely on the last whorl, which is smooth beneath, except behind the peristome; spire very low; whorls $6\frac{1}{2}$, flat above, the penultimate with a compressed keel which projects considerably beyond the last whorl, the latter convex around the umbilicus; breadth of body-whorl, seen from beneath, less than that of penultimate; aperture truncately oval, two parietal lamellæ, one in the middle of the parietal wall, the other smaller, close to the outer angle; peristome white, expanded, very slightly arcuate above on the outer border.

Length $12\frac{1}{2}$, breadth $7\frac{1}{2}$, height 6 mm.

Hab. Moulmein (*Stoliczka*); Mergui (*Mus. Cum.*).

b. *Shell finely costulate throughout, above and below.*

10. **Streptaxis sankeyi**, *Bs. A. M. N. H.* (3) iii, 1859, p. 472; *Pfr. Mon. Hel.* v, 1868, p. 442; *id. t. c.* vii, 1876, p. 494.
Streptaxis sankeyanus, *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 167, pl. 7, fig. 14; *Nev. Hand-l.* i, 1878, p. 3.

Shell very like that of *S. exacutus*, but the keel on the penultimate, though sharp, is not compressed, whilst the body-whorl is angulately compressed around the umbilicus. Only a single parietal lamella; columellar border of peristome quite straight.

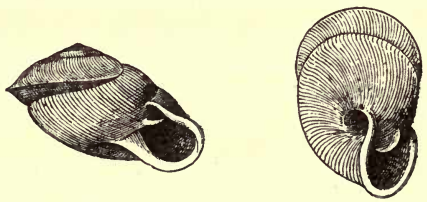


Fig. 7.—*Streptaxis sankeyi.*

Length $11\frac{1}{2}$, breadth $7\frac{1}{4}$, height $5\frac{1}{2}$ mm.; a smaller specimen measures 10, $6\frac{1}{2}$, and $5\frac{1}{4}$ mm.

Hab. Farm Caves, near Moulmein (*Stoliczka*); Mergui (*Mus. Cum.*).

11. **Streptaxis hanleyanus**, *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 168 pl. 7, fig. 15; *Pfr. Mon. Hel.* vii, 1876, p. 494.
Streptaxis sankeyi, *H. & T.* (*nec Benson*) *C. I.* 1876, pl. 8, fig. 7; *Nev. Hand-l.* i, 1878, p. 3.

Very near *S. sankeyi*, but narrower, with the penultimate whorl scarcely broader than the last whorl, and with the mouth almost rectangular and oblong, the outer margin being compressed and straight as well as the columellar. Generally, too, the present species is smaller and more depressed.

Length 7½, breadth 4¾, height 4 mm.; a larger specimen measures 10, 7, and 5 mm.; the latter is the form figured as *S. sankeyi* in the 'Conchologia Indica.'

Hab. Kwengon Hill, near Moulmein (*Theobald*).

II. Both parietal margin and inside of peristome tooth-bearing.

A. *Penultimate whorl rounded.*

a. *Globosely ovate; finely costulate above, narrowly umbilicated.*

12. **Streptaxis obtusus**, *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 166, pl. 7, figs. 11–13, pl. 8, figs. 1–4 (anatomy); *Pfr. Mon. Hel.* vii, 1876, p. 495; *Gude, Proc. Mal. Soc.* v, 1903, p. 323, pl. 12, figs. 8–10; *Nev. Hand-l.* i, 1878, p. 3.

Spire low, convex; whorls 7, flattened above, penultimate whorl bluntly subangulate below the middle and scarcely projecting beyond the last whorl, which is compressed around the umbilicus, and on which the sculpture becomes gradually fainter below; aperture slightly compressed on both sides, rounded externally, one parietal lamella with an additional tubercle near the angle; peristome with a small tubercular tooth inside the columellar margin, and another, still smaller and sometimes wanting, inside the outer margin, which is but slightly arcuate.

Length 10, breadth 7, height 6½ mm.

Hab. Chouktalon, a limestone hill south of Moulmein (*Theobald*).

b. *Depressedly ovate; striated or smooth.*

a'. *Lip of peristome not continued across parietal margin of aperture; 1 or 2 parietal lamellæ.*

b'. *Upper surface smooth, more or less striated.*

13. **Streptaxis theobaldi**, *Bens. A. M. N. H.* (3) iii, 1859, p. 187 *Pfr. Mon. Hel.* v, 1868, p. 449; *H. & T. C. I.* 1876, pl. 8, fig. 9 *G.-A. J. A. S. B.* xlv, pt. 2, 1876, p. 317, pl. 8, fig. 15; *Nev. Hand-l.* i, 1878, p. 3.

Shell arcuately rimate, smooth, whitish, translucent; spire low, convex; whorls 5–5½, convex above; penultimate whorl rounded, not projecting or scarcely projecting beyond the body-whorl when viewed from beneath; last whorl broader, swollen beneath, compressed around the umbilicus, rising on the penultimate whorl towards the mouth, with three indentations behind the peristome; aperture subtriangularly semi-ovate, with 7 teeth inside; peristome expanded, deeply cut back at the upper angle, with a lamellar fold

just inside the sinus and a larger elongate lamella in the middle of the parietal callus; of the other teeth three are inside the outer lip, the third lying in the curve, and two are columellar.

Length 6, breadth 4, height 3 mm.

Hab. Khási and Naga Hills, south of Assam; Dafla Hills, west of Bhutan, at low elevations (*G.-A.*); N.E. Manipur (*Ogle*); and Bhamo, Upper Burma (*Anderson*). A very globose broad shell, 5½ mm. long, 4½ broad, from the Naga Hills, in Col. Beddome's collection, may belong to a distinct form.

14. **Streptaxis daflaensis**, *G.-A. J. A. S. B.* xlv, pt. 2, 1876, p. 317, pl. 8, fig. 14.

This species is near *S. theobaldi*, but is slightly larger, with a lower spire; the umbilicus is broader and deeper, and there is only one lamella in the middle of the parietal callus, not a second close to the angle of the aperture.

Length 7, breadth 5, height 3½ mm.

Hab. Near Tanir Peak, Dafla Hills, east of Bhutan, 4000 feet.

15. **Streptaxis peroteti**, *Petit* (Helix), *Rev. Zool.* 1841, p. 100; *Pfr. Mon. Hel.* i, 1847, p. 9; *id. t. c.* (perrotteti) iii, 1853, p. 288; *id. t. c.* (perroteti) vii, p. 496; *H. & T. C. I.* 1876, pl. 98, figs. 5, 6; *Blf. J. A. S. B.* xlix, pt. 2, 1880, p. 205; *Nev. Hand-l.* i, 1878, p. 4.

Streptaxis latior, *Gude, Proc. Mal. Soc.* v, 1903, p. 323, pl. 12, figs. 1–4.

Shell rimate, rather thin, smooth and striated above, polished beneath, yellowish white; spire convex; whorls 5½, flatly convex above, penultimate rounded, projecting beyond the last whorl when viewed from below, last whorl flattened at the base, slightly broader than penultimate, indented behind the peristome; aperture semi-oval, slightly sinuate at angle; peristome white, expanded; parietal lamellæ normally two, close together, converging behind, that to the left median and longest, the other sometimes wanting;

Fig. 8.—*Streptaxis peroteti.*

teeth inside peristome three, one on right border, one basal, the third columellar (occasionally a small fourth tooth is found in the outer margin near the angle).

Length 10, breadth 6, height 4½ mm.; a smaller specimen 8, 6, and 4½ mm.

Hab. Plateau of Nilgiris; also Anaimalais and hills near Tinnevelly. A large variety has been found by Colonel Beddome in Ceylon, measuring 9½, 6½, 4¾ mm.

A variable shell; some specimens, apparently fully adult, have only one parietal lamella, and the extent to which the penultimate whorl, when viewed from below, extends beyond the body-whorl varies considerably. To this is due the difference in the proportion of length to breadth, shown by the measurements.

16. **Streptaxis footei**, *W. & H. Blf. J. A. S. B.* xxx, 1861, p. 358, pl. 2, fig. 6; *Pfr. Mon. Hel.* v, 1868, p. 448.

Near *S. peroteti*, but with only one tooth inside the peristome, situated about the middle of the outer margin; two parietal lamellæ; 5 whorls, the penultimate projecting very slightly when viewed from below, subumbilicated like *S. watsoni*.

Length 6½, breadth 5, depth 4 mm.

Hab. Sholamalai Plateau; Pachaimalais, near Salem, 3000 ft. A variety from Kalráyan Malai, another hill-group near Salem, collected by Colonel Beddome, has an additional basal tooth inside the peristome and the parietal lamella near the angle small or wanting.

17. **Streptaxis watsoni**, *W. & H. Blanf. J. A. S. B.* xxix, 1860, p. 126; *iidem, t. c.* xxx, p. 359, pl. 2, fig. 7; *Pfr. Mon. Hel.* v, 1868, p. 447; *H. & T. C. I.* 1876, pl. 8, fig. 8; *Nev. Hand-l.* i, 1878, p. 4.

Similar to *S. peroteti*, but considerably smaller; whorls 5, umbilicus larger and deeper, peristome more deeply sinuate at the angle, parietal lamellæ always 2, stronger and further apart, and teeth in the peristome more developed, from 3 to 5 in number.

Length 6, breadth 4¼, depth 3 mm.

Hab. Nilgiris; Wynaad, Anaimalais.

18. **Streptaxis beddomii**, *Blf.* (*Nev. MS.*) *P. Z. S.* 1899, p. 765, pl. 50, figs. 4–7.

Streptaxis pleurostomoides, *Gude, Proc. Mal. Soc.* v, 1903, p. 324, pl. 12, figs. 14–16.

Distinguished from *S. watsoni* by having a single parietal plait, and the teeth inside the peristome differently arranged. There are three small equal and equidistant teeth, one halfway down the columellar margin, a second farther down, and a third in the base, a fourth tooth inside the right margin. Although there is only one parietal plait, there is sometimes a tubercular swelling on the parietal wall at the termination of the sinus of the peristome.

Length 6, breadth 4⅓, height 3 mm.

Hab. Anaimalais (*Beddome*).

A larger variety with an additional upper tooth in the right margin, and with the three equal columellar and basal teeth rather nearer together, measuring 7, 5, and 3½, has been brought by Col. Beddome from near Kuttálam, Tinnevelly, 4000 feet above the sea. This appears to be *S. pleurostomoides* of Gude. A shell

from the Wynaad measuring 8, 6, and 4 mm. may be a still larger form.

19. **Streptaxis concinnus,** *Blf. J. A. S. B.* xlix, pt. 2, 1880, p. 203, pl. 2, fig. 11.

Subumbilicated, smooth, striated, whitish; spire convex, very low; whorls $5\frac{1}{2}$, convex; penultimate rounded, completely hidden by the broader last whorl when the shell is looked at from beneath in the line of the axis of the upper whorls; last whorl tumid and polished below, compressed around the umbilicus anteriorly, constricted by indentations behind the peristome; aperture with outer and columellar margins nearly straight and converging outwards, rounded at the base; peristome white, expanded, but little curved back at the angle; parietal lamellæ 2, both elongate, the inner long, and bent inside; teeth in peristome 5, two columellar, one small near the umbilicus, the other double; one transverse and lamellar at the base and two inside the outer margin.

Length $6\frac{1}{2}$, breadth 4, height 3 mm.

Hab. Balarangam Hills, Mysore.

This is very near *S. watsoni*, but distinguished by the penultimate whorl not projecting below.

20. **Streptaxis scalptus,** *Blf. P. Z. S.* 1899, p. 766, pl. 50, figs. 8, 9, 10.

Shell subumbilicated, moderately depressed, ovate; costulately striated above, smooth beneath, waxy, whitish; spire depressedly conoid; whorls $5\frac{1}{2}$–6, convex; penultimate rounded, projecting less than half its breadth beyond the last whorl when viewed from beneath; last whorl moderately convex, compressed laterally near the aperture, constricted by indentations behind the peristome; aperture semioval, contracted by one or (more often) two parietal lamellæ and by 3, 4, or 5 subequal palatal teeth, most commonly 4, one columellar, one distal, and two in the right margin.

Length 10, breadth 7, height $5\frac{2}{3}$ mm.

Hab. Kolamalai Hills, Salem district (*Beddome*); Balur in Kadur district, Mysore (*Daly*).

A specimen from Torna Hill, near Poona, Deccan, measuring $11\frac{1}{2} \times 8\frac{1}{2} \times 6$ mm., may perhaps be referred to this form.

21. **Streptaxis cingalensis,** *Bs. A. M. N. H.* (2) xii, 1853, p. 91; *Pfr. Mon. Hel.* iv, 1859, p. 333; vii, p. 496; *H. & T. C. I.* 1876, pl. 98, figs. 2, 3; *Nev. Hand-l.* i, 1878, p. 4.

Similar to *S. layardianus* (p. 5), but slightly larger, with the last whorl less excentric and rather more convex beneath; the deep sinus in the peristome at the angle always ends in a tubercle on the parietal wall, and there are two small tubercular teeth inside the peristome, one in the middle of the outer margin, opposite the ridge of the parietal plait, the other at the base of the columellar margin.

Length of type 11, breadth $8\frac{1}{3}$, height $5\frac{2}{3}$ mm. (*Benson*); a typical specimen lent to me by Mr. Layard measures 10, $7\frac{1}{3}$, and 5 mm.

This is, I think, merely a variety of *S. layardianus*. I have seen intermediate forms with rudimentary palatal teeth.

Hab. Hewagam Korale, S.W. Ceylon.

A small shell measuring $5\frac{3}{4} \times 4 \times 3$ from Ohiya, Ceylon, 6000′, is in Mr. Sykes's collection. It is a miniature of *S. cingalensis*.

22. **Streptaxis gracilis**, *Collett, Proc. Mal. Soc.* iii, 1898, p. 1.

Shell subperforate, depressed, smooth, whitish; spire low; whorls $4\frac{1}{2}$–5, convex above; the penultimate rounded behind, scarcely projecting beyond the last whorl when seen from below; last whorl convex beneath, slightly compressed around the umbilicus; aperture semioval; peristome slightly expanded, white, cut back into a rather deep sinus at the angle; a single parietal lamella, and one palatal tooth at the base of the columellar margin.

[The radula is very long; the teeth are similar to those of *S. pfeifferi*, only the centre tooth is rather longer in proportion to the first and second; the formula is 25 . 1 . 25. The buccal mass is as described by Stoliczka.]

Length $4\frac{1}{2}$, breadth $3\frac{1}{2}$, depth $2\frac{1}{4}$ mm.

Hab. Near Lemastota, Uva Province, Ceylon.

23. **Streptaxis lævis**, *Blf. P. Z. S.* 1899, p. 765, pl. 50, figs. 11, 12.

Similar to *S. burmanicus* (p. 6), but smooth and finely striated, not costulate above, and with a minute basal tooth inside the peristome in all (3) specimens examined; in one specimen there are two teeth.

Hab. Burma (*Beddome*).

24. **Streptaxis ravanæ**, *Blf. P. Z. S.* 1899, p. 768, pl. 50, figs. 13, 14, 15.

Shell rimate, minutely perforate, striated; spire low, convex; whorls 7, flattened above, penultimate rounded, only just projecting beyond the body-whorl when seen from below; last whorl flattened beneath, compressed anteriorly around the umbilicus; aperture semioval, with one parietal plait and 4 (or 5) palatal teeth, two on the right margin, one distal and one near the base of the columellar border, with a second rudimentary tooth higher up; peristome expanded, cut back into a moderate sinus at the angle.

Length $13\frac{1}{2}$, breadth 10, height 7 mm.

Hab. Ceylon. I have long had a specimen, but do not know the exact locality.

a''. *Peristome continued by a thick lip, bearing a single re-entering* **Y**-*shaped lamella, across parietal margin.*

25. **Streptaxis personatus**, *Blf. J. A. S. B.* xlix, pt. 2, 1880, p. 202, pl. 2, fig. 10.

Shell umbilicated, smooth, pale yellowish white ; spire depressed ; whorls 5, slightly convex above, the penultimate rounded, scarcely projecting beyond the last, which is slightly compressed around the umbilicus, constricted and pitted behind the mouth ; aperture semioval ; peristome thickened and expanded, continuous across the last whorl, with a deep sinus at the angle and furnished inside with a thick parietal lamella, two teeth inside the outer, and three in the columellar margin, the lower and larger of the teeth inside the outer border opposite to top of the parietal lamina.

Length 5, breadth 4, height $2\frac{1}{2}$ mm.

A larger variety, $6\frac{1}{2}$ mm. long, has only three or four teeth inside the peristome, not counting the parietal lamella.

Hab. Hills near Cumbum, Madura, South India ; Peermede, Travancore ; Shevroys (*Beddome*).

26. **Streptaxis pronus**, *Blf. J. A. S. B.* xlix, pt. 2, 1880, p. 204, pl. 2, fig. 12.

Near *S. personatus*, but costulately striated above, and with the last whorl very excentric, the penultimate, when seen from below, projecting by more than half its breadth ; whorls $5\frac{1}{2}$, penultimate rounded, last whorl somewhat flattened beneath, sharply compressed around the umbilicus, subcostulate within ; aperture elongate, truncately oval ; peristome white, expanded, with 4 teeth, 1 columellar, 1 basal, and 2 in outer margin, besides the parietal lamella, which is curved within and subbifid in front ; the sinus at the angle of the peristome well marked, but much less deep than in *S. personatus*.

Length $6\frac{1}{2}$, breadth 4, depth 3 mm.

Hab. Hills near Tinnevelly, S. India (*Beddome*).

B. *Penultimate whorl carinate.*

*27. **Streptaxis elisa**, *Gould, Proc. Bost. Soc. N. H.* vi, 1856, p. 13 ; *Pfr. Mon. Hel.* v, 1868, p. 448.

Shell of moderate size, much distorted and compressed, finely striated above, smooth beneath and broadly perforated ; spire discoid ; whorls $7\frac{1}{2}$, angulate near the deep suture, the last very much extended laterally ; aperture transverse, subquadrate ; peristome everted, armed inside with 4 teeth cruciformly disposed, a small fifth posterior tooth being sometimes added.

Length half an inch ($12\frac{1}{2}$ mm.), height one quarter inch (6 mm.) (*Gould*, Lat.).

Hab. An island in the Mergui Archipelago (*Rev. J. Benjamin*).

28. **Streptaxis canaricus,** *Blf.* (*Beddome MS.*) *J. A. S. B.* xxxviii, pt. 2, 1869, p. 142, pl. 16, fig. 11; *Pfr. Mon. Hel.* vii, 1876, p. 497; *H. & T. C. I.* 1876, pl. 156, figs. 7, 8; *Nev. Hand-l.* i, 1878, p. 3.

Shell umbilicated, depressed, finely costulate above and below; spire very low, conical; whorls $5\frac{1}{2}$, nearly flat above; penultimate sharply keeled, projecting by more than half its width beyond the body-whorl, when seen from below; last whorl flatly convex beneath, compressed around the umbilicus; constricted by indentations behind the peristome; aperture semioval, rather broad; peristome continuous, expanded, curved back considerably at the angle, a thick, flexuous, deeply re-entering parietal lamella, and 6 palatal teeth.

Fig. 9.—*Streptaxis canaricus.*

Length $7\frac{1}{2}$, breadth 6, height $3\frac{1}{2}$ mm.

Hab. South Canara (*Beddome*).

29. **Streptaxis subacutus,** *Blf. P. Z. S.* 1899, p. 767, pl. 50, figs. 1, 2, 3.

Shell rimate, perforate, depressedly ovate, solid, with flexuous costulate striation above, smooth beneath; spire depressedly conoid; whorls $6\frac{1}{2}$, flattish, penultimate obtusely keeled, projecting by fully half its breadth beneath beyond the last whorl, which is slightly convex below, compressed and subangulate near the aperture, rugosely striated inside the umbilicus; indented outside behind the peristome; aperture semioval, with 1 or 2 parietal lamellæ, the outer small or wanting, and 3 palatal teeth; peristome expanded, moderately curved back at the angle.

Length $11\frac{1}{2}$, breadth 8, height 6 mm.

Hab. South Canara (*Beddome*).

30. **Streptaxis compressus,** *Blf. J. A. S. B,* xlix, pt. 2, 1880, p. 201, pl. 2, fig. 13.

Shell openly subumbilicated, very depressed, striate, translucent, dull yellowish; spire almost flat; whorls $4\frac{1}{2}$, flattened above, but with the suture impressed, the penultimate whorl bluntly carinate, projecting by nearly its whole breadth when seen from beneath, last whorl flattened below except near the peristome, where it is compressed into a ridge, indented behind the aperture, which is nearly semioval, but with the margins converging distally; peristome expanded, slightly sinuate at angle; parietal lamella bifid or double; palatal teeth 4 or 5, two columellar teeth being close together and generally united.

Length $6\frac{1}{2}$, breadth $3\frac{3}{4}$, height 3 mm.

Hab. Sivagiri Hills, Tinnevelly; and hills near Cumbum in same district. The variety from the latter locality is filiformly striated above and within the umbilicus, and the parietal lamella is double.

Genus ENNEA.

Ennea, *H. & A. Adams, Gen. Rec. Moll.* ii, 1858, p. 171; *Stol. J. A. S. B.* xl, pt. 2, 1871, p. 169 (anatomy of *E.* (*Huttonella*) *bicolor*).

Type, *E. bicolor*, Hutt.

Range. Throughout Southern and South-eastern Asia from Arabia to Japan and the Philippines; also Madagascar, with the Mascarene Islands, and throughout tropical and Southern Africa.

Shell pupiform, ovate, cylindrically ovate or turreted, hyaline in structure. All Indian species have plaits or teeth in the aperture, and all, except one Nicobar form, are imperforate and arcuately rimate.

Animal like that of *Streptaxis*. No jaw. Radula similar; that of *Ennea bicolor* is long, containing between 80 and 90 rows of teeth, with 19 teeth (9 . 1 . 9) in each row. The median tooth is short, sharply pointed, with an enlarged knob on each side towards the base; the laterals are longer, slightly curved, each with a blunt knob on the outer side; their size decreases outwardly (*Stoliczka*). According to Morelet, *Ennea* is viviparous, producing one young at a time.

I. Imperforate, rimate.

A. *Aperture subaxial, not truncated above, oval, with an accessory, nearly circular, portion on the right almost cut off by a parietal lamella and a palatal fold or swelling; peristome white, expanded, continuous, indented at parietal lamella, deeply sinuate around subtubular accessory portion of aperture.*

a. *Peristome united to penultimate whorl and partly covering it.*

31. **Ennea vara**, *Bs.* (Pupa) *A. M. N. H.* (3) iii, 1859, p. 188; *Pfr. Mon. Hel.* v, 1868, p. 455; *G.-A. P. Z. S.* 1872, pl. 30, fig. 6; *Pfr. t. c.* vii, 1876, p. 501; *H. & T. C. I.* 1876, pl. 100, fig. 3; *Nev. Hand-l.* i. 1878, p. 7.

Spire elongately ovate, subfusiform, white, strongly ribbed

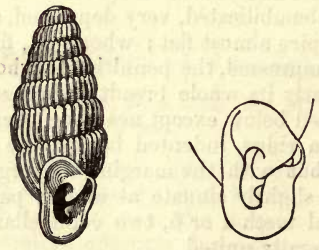


Fig. 10.—*Ennea vara* ♀, and aperture ♀.

vertically; spire turreted, regularly diminishing, apex obtuse; whorls 8, slightly convex, the last much compressed laterally,

bluntly subangulate beneath, ascending in front; aperture vertical, with a slight columellar callosity, but no plait, the accessory tubular portion almost halfway down the right margin; peristome broadly expanded.

Length $5\frac{1}{2}$, breadth 2, length of aperture and peristome nearly 2 mm.

Hab. Khási Hills; Jaintia and N. Cachar Hills (*G.-A.*).

32. **Ennea stenopylis**, *Bs. A. M. N. H.* (3) v, 1860, p. 460; *Pfr. Mon. Hel.* v, 1868, p. 455; *G.-A. P. Z. S.* 1872, pl. 30, fig. 5; *Pfr. t. c.* vii, 1876, p. 501; *Nev. Hand-l.* i, 1878, p. 7.

Shell ovate, somewhat flexuously and obliquely costulate, whitish horny; apex obtuse; whorls $6\frac{1}{2}$, narrow, slightly convex, antepenultimate broadest, last whorl much compressed laterally, indented externally behind the peristome; aperture vertical, no columellar plait.

Length $3\frac{1}{2}$, breadth $2\frac{1}{2}$, height ap. $1\frac{1}{4}$ mm.; in another specimen length $3\frac{3}{4}$, breadth 2 mm. Benson's type was $3\frac{1}{2}$ and $1\frac{1}{2}$, showing much variation.

Hab. Sikhim, about 4000′; Dafla Hills, Khási Hills, Naga Hills; Manipur (*G.-A.*).

33. **Ennea nagaensis**, *Blf.* (*Godwin-Austen MS.*) *P. Z. S.* 1899, p. 769, pl. 50, fig. 22.

Near *E. stenopylis*, but larger and more elongate, with 7 whorls; and with the broadly expanded peristome of *E. vara*. Costulation fine, close, oblique, and flexuous.

Length $4\frac{3}{4}$, breadth 2, height of aperture $1\frac{2}{3}$ mm.

Hab. Naga Hills.

34. **Ennea blanfordiana**, *G.-A. P. Z. S.* 1872, p. 515, pl. 30, fig. 4; *Pfr. Mon. Hel.* vii, 1876, p. 501; *H. & T. C. I.* 1876, pl. 100, fig. 2.

Shell cylindrically ovate, obliquely costulate on upper whorls, almost smooth and polished on the lower, whitish horny, translucent, spire with nearly straight lines, becoming curved near apex, which is obtuse; whorls $8\frac{1}{2}$, the last two or three sometimes slightly narrower across the shell than fifth and sixth, the last compressed laterally, indented on outer side behind peristome; aperture vertical, with the subtubular accessory portion higher up the right margin than in *E. stenopylis* and *E. vara*, a small tubercle inside dextral margin on the palatal fold, and a deep-seated columellar fold.

Length 7, breadth $2\frac{1}{2}$, length of aperture with peristome $1\frac{1}{2}$–2 mm.

Hab. North Cachar, Mahadeo Peak near Asalu, 5700′. A smaller variety, measuring $5\frac{3}{4}$ mm. in length, was found at Hemeo Peak in the same district.

35. **Ennea fartoidea**, *Theob.* (Pupa) *J. A. S. B.* xxxix, pt. 2, 1870, p. 400; *Pfr.* (Pupa) *Mon. Hel.* viii, 1877, p. 372.
Pupa (Ennea) fartoides, *H. & T. C. I.* 1876, pl. 100, fig. 5; *Nev.* (Ennea-Huttonella) *Hand-l.* i, 1878, p. 7.

Shell scarcely rimate, subcylindrically ovate, obliquely costulate, the sculpture becoming fainter or obsolete on the lower whorls; spire as in *E. blanfordiana*; whorls 7–8, fourth or fifth broadest, the last very little compressed, slightly ascending; aperture slightly inclined, not vertical, no columellar or basal teeth; the subtubular appendage higher than in the last three species, quite at the angle of the aperture.

Length 4, breadth 1½, height of aperture 1 mm.

Hab. Shan States, Burma (*F. Fedden*).

36. **Ennea milium**, *Godwin-Austen, J. A. S. B.* xlv, pt. 2, 1876, p. 317, pl. 8, fig. 11 (teeth in mouth require correction); *Blf. P. Z. S.* 1899, pl. 50, figs. 18, 19.

Like *E. fartoidea*, but much smaller and with only six whorls, the upper three obliquely costulate, the lower three smooth, amber-coloured; aperture with a curved parietal plait, three tubercular palatal teeth and an internal columellar lamella; of the palatal teeth two are in the right margin, the upper being opposite the parietal lamella, and the third in the base is low and broad. Peristome white, expanded.

Length 2½, breadth 1 mm.

Hab. Shengorh Peak, 7000′, Dafla Hills, north of Assam (*G.-A.*). Only a single specimen known.

b. *Peristome free from penultimate whorl.* (DIAPHORA.)

37. **Ennea cylindrelloidea**, *Stol.* (Ennea-Huttonella) *J. A. S. B.* xl, pt. 2, 1871, p. 171, pl. 7, fig. 4; *Pfr.* (Ennea) *Mon. Hel.* vii, 1876, p. 507; *H. & T.* (Pupa-Ennea) *C. I.* 1876, pl. 160, fig. 10.

Shell turreted, finely and closely vertically costulate, except on the uppermost whorls; spire slightly but regularly diminishing, apex obtuse, sutures deep; whorls 8, convex, swollen below the suture, the last two slightly narrow, the last bluntly keeled at the base, free near the aperture, slightly descending; aperture slightly inclined, rounded, the parietal lamella thick and oblique; peristome expanded all round.

Length 4½, breadth 1·3, length of aperture 0·9 mm. (*Stoliczka*).

Hab. Damotha, near Moulmein.

A specimen in the British Museum from Damotha, presented by Dr. Hungerford, approaches the above species in many respects, but it is smooth, with the sides of the spire slightly concave above. It is 4 mm. long. This is probably an undescribed form, but it looks slightly distorted, so I shall not propose a name for it.

38. **Ennea seatoni**, *Beddome, P. Z. S.* 1891, p. 315, pl. 29, figs. 15–19.

Similar to *E. cylindrelloidea*, but considerably larger, with 10½–11 whorls, finely, not very closely costulated. The aperture is very differently shaped, being oval, considerably higher than broad, with the subtubular portion in the right upper corner almost cut off by a vertical parietal lamella and a thickened subangular plait inside the outer margin; both of these plaits are twisted inside, so as to appear from the aperture like additional teeth, there is also an internal obliquely descending columellar fold and another external lamella just visible from the front; peristome expanded throughout, deeply sinuate at the angle; last whorl free for a short distance behind the peristome, compressed and bluntly subangulate at the base.

Length 9, breadth 2¼, height of aperture nearly 2 mm.

Hab. Limestone rocks east of Mooleyit, near Siam frontier, Tenasserim.

39. **Ennea brevicollis**, *Blf. P. Z. S.* 1899, p. 768, pl. 50, figs. 16, 17.

Intermediate in size and form between *E. cylindrelloidea* and *E. seatoni*, distinguished from the former by larger size, coarser

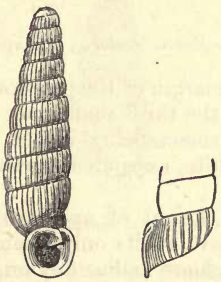


Fig. 11.—*Ennea brevicollis.* 2/1.

and more distant filiform costulation, and from the latter by its differently shaped mouth, which is nearly as broad as high. Whorls 11, all, except the upper three, filiformly costulate, the last solute for a short distance and closely costulate where free. No columellar lamellæ.

Length 8, breadth 2, height of aperture 1⅓ mm.

Hab. Moulmein (*Theobald*).

B. *Aperture semioval or oblong; generally truncated above.*

a. *Shell turreted.* (Huttonella).

40. **Ennea bicolor**, *Hutton* (Pupa), *J. A. S. B.* iii, 1834, pp. 86 & 93; *Pfr.* (Pupa) *Mon. Hel.* ii, 1848, p. 352; *Bs.* (Pupa) *A. M. N. H.* (2) iv, 1849, p. 125; *Pfr. Mon. Hel.* iv, 1859, p. 342; *Semper, Reis. d. Phil.* iii, 1890–94, pl. 8, fig. 14; *Stol.* (Ennea-Huttonella) *J. A.*

S. B. xl, pt. 2, 1871, p. 169; *Pfr. Mon. Hel.* vii, 1876, p. 505; *H. & T.* (Pupa) *C. I.* 1876, pl. 100, fig. 6; *Nev.* (Ennea-Huttonella) *Hand-l.* 1878, p. 6.

Pupa mellita, *Gould, Proc. Bost. Soc. N. H.* ii, 1846, p. 98.

Pupa (Ennea) ceylanica, *Pfr. P. Z. S.* 1855, p. 9; *id. Mon. Hel.* iv, 1859, p. 342; *H. & T. C. I.* 1876, pl. 100, fig. 4.

Shell subcylindrically turreted, smooth, polished, translucent, yellowish white; spire slightly attenuate above, apex very obtuse, suture impressed, crenulate; whorls 7 (6–8½), slightly convex, the last deeply indented externally and basally behind the peristome; aperture nearly vertical, truncated, semioval, containing four teeth, one parietal fold, close to the angle, continuous with the peristome and running into the columellar side; the second the largest,

Fig. 12.—*Ennea bicolor* 4/1, and aperture 8/1.

triangular, on dextral margin of the peristome, opposite the first *; peristome subtubular, the third small and basal, the fourth columellar, a curved fold commencing inside and running obliquely inwards; peristome white, expanded, curved back into a sinus at the angle.

Length 7, breadth 2, height of aperture 1½ mm. Other specimens are smaller; I have adults only 4 mm. long.

Hab. Almost throughout India, Ceylon, Burma, and Nicobar Islands, chiefly in open or cultivated plains, not, as a rule, in forest. This shell occurs throughout the greater part of the Indian region, also in the Seychelles and Mascarene Islands, and in several islands of the West Indies, where it has probably been introduced by man.

The spire varies considerably, some shells being much more attenuate above than others.

[The animal, taken from Stoliczka's description, has a long body, laterally strongly compressed, posteriorly shortened, though on the whole a little more produced than in *Streptaxis*, more or less distinctly yellowish, on the head reddish; pedicles long, slightly thickened at the end, their external skin is yellow, but the internal eye-bearing peduncles are vermilion; eyes very small; tentacles small, pale reddish; mantle deep red. The internal anatomy

* [Stoliczka says, and he examined the animal, "Two of the teeth are placed at each side of the posterior (or upper) angle of the mouth, producing a sort of canal, in which terminates the pulmonary orifice and the anus."]

exactly corresponds with that of *Streptaxis*. The radula is very long, the sides curved up like a sheath of a bamboo-leaf. The centre tooth is short, sharply pointed, with a rapidly widened base. The adjoining and following teeth are longer and slightly curved, decreasing in size outward, and arranged 9 . 1 . 9. It is carnivorous. In January 1897 Mr. Collett took specimens off the sea-wall at Galle, Ceylon, preying upon *Opeas gracilis*, which it resembles somewhat. The long anterior body, combined with the protrusive odontophore, of *E. bicolor* enables the creature to enter and reach the furthest internal whorls of *O. gracilis* and other shells.]

41. **Ennea macrodon**, *Blf. J. A. S. B.* xlix, 1880, p. 205, pl. 2, fig. 15

Shell turreted, pale, horny, with fine, close, vertical hair-like costulation; spire diminishing very slightly above, apex obtuse; whorls 7, convex, the last ascending slightly near the aperture, not indented; aperture vertical, semioval, obliquely truncated above, almost filled up with teeth, consisting of a prominent high re-entering subbifid parietal plait, a small tubercular tooth in the right margin, a large lamelliform obliquely transverse basal tooth

Fig. 13.—*Ennea macrodon*. 5/1.

inside the lip, and a blunt columellar tooth; another deep lamella running into the shell is seen behind the basal one; peristome white, expanded, sinuate at angle, margins united by a distinct callus.

Length 5, breadth 2, height of aperture 1¼ mm.

Hab. Pykára, Nilgiri Hills.

Young shells in this and the next five species have the dentition of the aperture fully developed.

42. **Ennea subcostulata**, *Blf. J. A. S. B.* xlix, 1880, p. 206, pl. 2, fig. 14 (upper fig.).

Very near *E. macrodon*, chiefly distinguished by the filiform costulation being almost or quite obsolete. The teeth in the aperture are similar but less massive, and in the only adult specimen examined the broad lamellar basal tooth is replaced by two tubercular teeth.

Length 5½, breadth 2, height of aperture 1¼ mm.

Hab. Shevroy Hills, S. India.

43. **Ennea turricula,** *Blf. P. Z. S.* 1899, p. 768, pl. 50, figs. 16, 17.

Distinguished from *E. macrodon* by having slightly coarser and less close filiform costulation, only six whorls, and by the plaits inside the mouth being much less developed. In adult shells only the parietal plait remains conspicuous, but there are deep-seated basal and columellar lamellæ; in younger specimens with the peristome thickened and expanded a small basal tubercle also occurs. The transverse basal lamella of *E. macrodon* is wanting, and the parietal plait is simple.

Length 5, breadth 1¾ mm.

Hab. Anaimalai Hills, 4000′; also S. Canara (*Beddome*).

44. **Ennea exilis,** *Blf. J. A. S B.* xlix, 1880, p. 207, pl. 2, fig. 14 (lower fig.; all the teeth are wrongly represented).

Similar to *E. macrodon*, but much more slender and entirely smooth, thin, and translucent. Whorls 6½–7. The teeth are smaller, the parietal lamella bears two knobs, but is not bifid; the basal plait is represented by two tubercular teeth united at the base and running obliquely into the shell; the only internal plait is columellar rather than basal, and not directly behind the basal tooth; the columellar and dextral teeth are simply tubercular.

Length 4½, breadth 1½, length of aperture 1 mm.

Hab. Balarangam Hills, Mysore.

45. **Ennea pirriei,** *Pfr.* (Pupa) *P. Z. S.* 1854, p. 295; *id.* (Ennea) *Mon. Hel.* iv, 1859, p. 341; *id. t. c.* vii, 1876, p. 505; *H. & T.* (Pupa-Ennea) *C. I.* 1876, pl. 100, fig. 1; *Nev.* (Ennea-Huttonella) *Hand-l.* i, 1878, p. 7.

Shell turreted, very slightly diminishing above, whitish horny; upper whorls smooth, last two with very fine hair-like costulation; apex obtuse; whorls 7, slightly convex, the last compressed at the base; aperture roundly semioval; peristome white, expanded, margins joined by a thick callus, which is deeply indented above at the place where it bears a parietal lamella running into the whorl, there is also a columellar plait running obliquely inwards and commencing inside the mouth; no teeth in the basal or dextral margins.

Length 10, breadth 2½, height of aperture 2 mm.

Hab. Koondah Hills (Western portion of Nilgiris) (*Pirrie*).

46. **Ennea sculpta,** *Blf. J. A. S. B.* xxxviii, 1869, p. 141, pl. 16, fig. 10; *Pfr. Mon. Hel.* vii, 1876, p. 504; *H. & T.* (Pupa-Ennea) *C. I.* 1876, pl. 160, fig. 1; *Nev.* (Ennea-Huttonella) *Hand-l.* i, 1878, p. 7.

This differs from *E. pirriei* chiefly in being coarsely ornamented with vertical slightly flexuous ribbing throughout except on the first two whorls. The callus that unites the margins of the peristome is not indented above the parietal lamella which is near

the angle. Right margin of peristome slightly arcuate. A deep columellar plait and four palatal lamellæ inside the aperture, not easily seen from it.

Length 8½, breadth 2½, height of aperture 2 mm.

Hab. Pulney Hills, S. India (*Fairbank*).

47. **Ennea beddomii**, *Blf. J. A. S. B.* xlix, 1880, p. 210; *Blf. P. Z. S.* 1899, p. 770, pl. 50, figs. 20, 21.

Shell turreted, pale yellowish white, vertically ribbed; spire tapering slightly but regularly above, apex obtuse; whorls 6, convex, the last rounded beneath; aperture rounded, truncated above, with one strongly developed parietal lamella entering deeply and a little twisted within, and a smaller deep-seated columellar fold, two or three small internal palatal teeth, and a blunt tubercular swelling inside the right margin opposite the parietal fold; peristome white, broadly expanded, continuous, curved back at the angle.

Length 3⅔, breadth 1⅓, height of aperture ⅔ mm.

Hab. Sivagiri Hills, near Tinnevelly.

48. **Ennea canarica**, *Blf.* (*Beddome MS.*) *J. A. S. B.* xlix, 1880, p. 210; *id. P. Z. S.* 1899, p. 770, pl. 50, fig. 25.

Shell turreted, vertically ribbed, white; spire regularly diminishing upwards, apex blunt; whorls 6, convex, swollen beneath the suture, the last not ascending, rounded beneath; aperture rounded below, cut off in a straight line above, with a large parietal lamella and a small palatal swelling, opposite to each other, almost cutting off the area near the angle, a large internal columellar plait, also a minute parietal and a small basal tooth, both inside the mouth; peristome continuous, thickened, broadly expanded, slightly curved back near the angle.

Length almost 4, breadth 2 mm.

Hab. South Canara.

b. *Shell ovate.*

49. **Ennea planguncula**, *Bs.* (Pupa) *A. M. N. H.* (3) xii, 1863, p. 426; *Pfr.* (Pupa) *Mon. Hel.* vi, 1868, p. 329; *H. & T.* (Pupa) *C. I.* 1876, pl. 101, fig. 2; *id. t. c.* pl. 160, fig. 3 (var.); *Nev.* (Ennea-Huttonella) *Hand-l.* i, 1878, p. 7.

Ennea stenastoma, *Blf.* (*Beddome MS.*) *J. A. S. B.* xlix, 1880, p. 208, pl. 2, fig. 17.

Shell deeply rimate, cylindrically ovate, whitish, minutely obliquely costulate; spire cylindrical, with the sides straight, but becoming convex towards the obtuse apex; suture crenulate; whorls 6½, slightly convex, the last compressed laterally and deeply indented on both sides behind the peristome; aperture vertical, subaxial, oblong, higher than broad, both right and left margins concave, basal margin convex, the mouth greatly contracted by the following large teeth:—(1) a thick parietal fold

near the angle and (2) a large tubercular subbifid tooth on the right margin, both running into the whorl; also two columellar tubercular teeth, the larger just inside the lip, the smaller internal, and two small basal teeth right and left; peristome white, expanded, sharply curved back at the angle.

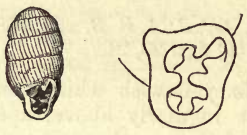


Fig. 14.—*Ennea planguncula* $\frac{4}{1}$, aperture $\frac{1}{1}^{2}$.

Length $3\frac{1}{2}$, breadth $1\frac{1}{2}$, length of aperture $1\frac{1}{4}$ mm.

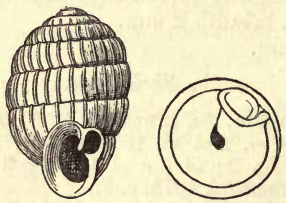
Hab. Peninsula of India; Orissa (*Theobald*); Golconda Hills, near Vizagapatam and Rusellcoonda (*Beddome*); Nerbudda Valley, near Hashungabad.

A smaller variety, with $5\frac{1}{2}$ whorls, 3 mm. long, was obtained by Col. Beddome from hills near Kurnool. This is the form figured in the Conchol. Ind. pl. 160, fig. 3. I have seen a specimen of what is probably a variety from Ceylon. The fine oblique costulation and sutural crenulation often disappear.

II. Umbilicated.

*50. **Ennea moerchiana**, *Nev.* (*Roepstorf MS.*) *J. A. S. B.* 1, 1881, p. 130; *Godwin-Austen, P. Z. S.* 1895, pp. 443, 450.

Shell deeply but narrowly umbilicated, cylindrically ovate, subvertically rather distantly ribbed, white, solid; apex obtusely conoidal; whorls $6\frac{1}{2}$, convex, fourth and fifth broadest, last rounded at base, ascending in front, partly covering umbilicus; aperture



ig. 15.—*Ennea moerchiana* $\frac{4}{1}$, and view of base.

vertical, subaxial, rounded, parietal fold vertical, well developed, another strong but less prominent fold within right margin, no other teeth; peristome broadly reflected, deeply sinuate above the dextral fold.

Length $4\frac{2}{3}$, breadth $2\frac{3}{4}$ mm.

Hab. Centre of Great Nicobar.

Family ZONITIDÆ.

Subfamily ARIOPHANTINÆ.

[The *Ariophantinæ* form a very distinct subfamily of the Indian Mollusca, and are almost exclusively confined to the Peninsular area and Ceylon; only two species are found extending a short distance northward into the Gangetic delta, but have not been recorded from that of the Brahmaputra River. The largest Indian

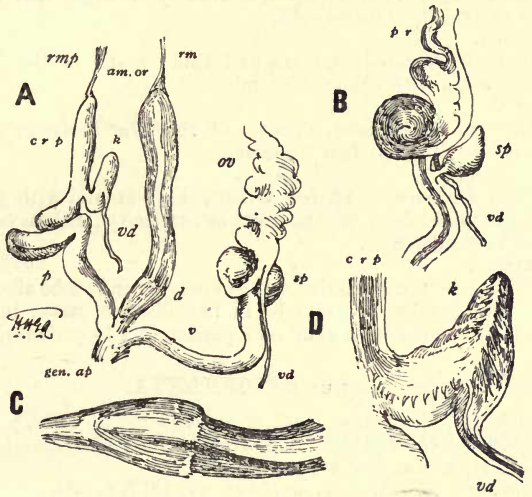


Fig. 16.—*Ariophanta lævipes.*

A. Genitalia. × 3.
B. Ditto, part of, showing spermatheca.
C. Portion of male organ near junction of vas deferens, showing position of a spermatophore.
D. Terminal end of the amatorial organ or dart.

am.or. Amatorial organ or dart.
crp. *Cæcum musculi retractoris penis* of Semper.
d. Dart.
gen.ap. Generative aperture.
k. Kalc-sac.
ov. Oviduct.
p. Penis.
rm. Retractor muscle.
rmp. Retractor muscle of penis.
sp. Spermatheca.
v. Vagina.
vd. Vas deferens.

land-shells belong to this subfamily. All are large and fine forms, both sinistral and dextral; they vary much in form from solid, turbinate, to thin and very globose shells, and to others *Helicarion*-like, thin, diaphanous, and membranaceous.

The generative organs have three marked characters, viz., the penis cæcum ("cæcum musculi retractoris penis" of Semper), to which the retractor muscle is attached; a very small pear-

shaped or sessile spermatheca or sperm-sac, and conformably with it a very short spermatophore of peculiar form with close-set spines, different altogether from that of the *Macrochlaminæ*.

Fig. of animal, Pl. I. figs. 1 & 2.]

[*Synopsis of Genera.*

1. ARIOPHANTA.
   With sinistral shells, solid or horny and thin; left dorsal lobe distinctly separate in two parts. Most species with aculeate laterals in the radula.
2. NILGIRIA, CRYPTOZONA, XESTINA.
   Dextral shells, mostly solid, and many of large size; left dorsal lobe undivided, or merely slit.
3. INDRELLA.
   Shell *Helicarion*-like, large and thin; a slit in the left dorsal lobe; radula with aculeate laterals.
4. RAVANA.
   Shell thin, depressed, smooth, of the *Macrochlamys* type; left dorsal lobe divided; foot truncate.
5. RATNADVIPIA.
   Shell *Helicarion*-like, few whorls, thin; animal with both right and left shell-lobes; foot truncate at extremity; radula very broad; teeth very numerous.
6. EUPLECTA.
   Shell in most cases carinate and closely wound; lobe above mucous pore more pointed; dorsal lobe in two distinct parts; in the male organ a muscular band confines a portion in a looped arrangement.]

Genus ARIOPHANTA.

Ariophanta, *Desmoulins, Bull. Soc. Bordeaux*, iii, 1829, p. 235, pl. 1, figs. 1–5; *G.-A. Moll. Ind.* i, 1883, p. 133; *id. t. c.* ii, 1898, p. 82; *Blf. Proc. Mal. Soc.* iv, 1901, p. 241.
Cryptozona, *Mörch, Jour. de Conch.* xx, 1872, p. 334.
Xestina, *Pfeiffer, JB. mal. Ges.* v, 1878, p. 257; *id. Abh. Ver. Hamb.* vii, 1883, p. 13; conf. *v. Mart. Zool. Rec.* xv, 1880, p. 162.
Nilgiria, *G.-A. Mol. Ind.* i, 1888, p. 253; *id. t. c.* ii, 1898, p. 77, & 1899, p. 123.

Type, *A. lævipes* (Müll.).

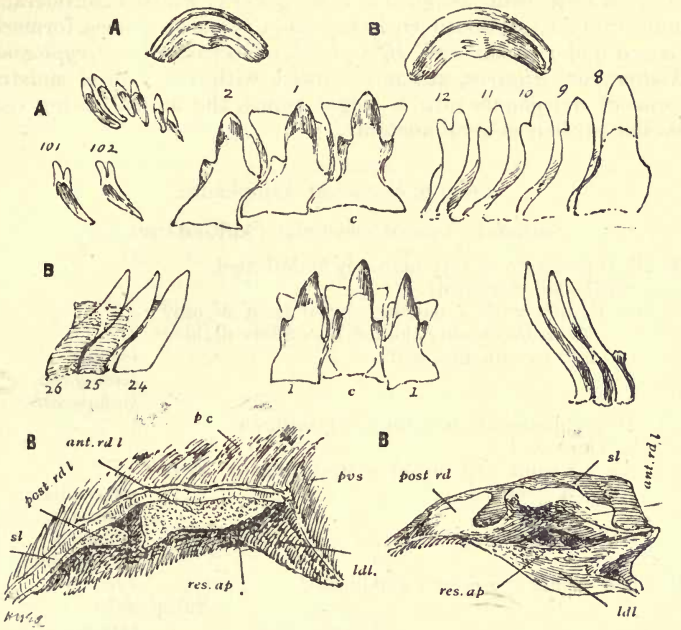
Range. The Indian Peninsula and Ceylon.

Shell sinistrorse or dextrorse, perforate or umbilicated, of moderate or large size, depressed or globose, striated or decussately striated above, smoother beneath; peristome thin in general, but not always, the columellar margin more or less reflected.

Animal with the body when extended rather broad and depressed (broader than that of *Macrochlamys*). A large mucous pore above the flattened posterior extremity of the foot, without any horn-shaped lobe above (a small blunt lobe is sometimes present); peripodial groove well developed, always double; sole broad, not distinctly divided beneath; upper surface of body with oblique striæ, those on the head and neck anastomosing and forming a distinct tract. The mantle-edge is a narrow band reflected over the peristome. No shell-lobes; the two dorsal lobes

are well developed, the left (right in sinistral forms) divided into two [a large anterior and a much smaller posterior; in the dextral forms, type *solata*, the left dorsal lobe is continuous, or a mere slit divides it into two as in *basileus*].

In the genitalia there is a kalc-sac, often of large size, which receives the *vas deferens*; a simple diverticulum or cæcum, varying



[Fig. 17.—A. *Ariophanta lævipes*. Jaw and teeth of the radula, × 300.
B. *Ariophanta immerita*. Jaw and teeth of radula, × 155; and mantle-edge, viewed from the outside and from below, showing the dorsal lobes, × 3.

ant.rdl. Anterior right dorsal lobe.
post.rdl. Posterior right dorsal lobe.
ldl. Left dorsal lobe.
res.ap. Respiratory aperture.
pvs. Parietal side of visceral sac.
sl. Shell-lobe.
pc. Pulmonary cavity.]

in length, leads from the junction of the kalc-sac and penis-sheath to the retractor muscle; the amatorial organ or dart-sac is long and more or less cylindrical; the spermatheca (receptaculum seminis) is small, globose, and either sessile or with a short stalk.

Radula broad, with numerous teeth in each row: rhachidian (central) tooth tricuspid, the side cusps small and basal; the inner laterals broad, bi- or tricuspid, forming a band of varying width down the middle of the radula, distinct from the area occupied by the outer laterals, which are elongate and uni- or bicuspid and

pass into aculeate pointed marginals. Jaw curved, with a small median projection.

The egg of *A. lævipes* is elliptical, longitudinally sulcated, enclosed in a tough membrane, and 4 to 5 mm. in length, 4 to 4½ in diameter. That of *A. interrupta* is similar.

This genus is now regarded as confined to the Indian Peninsula and Ceylon, various Burmese and Malay sinistral forms, formerly referred to it, being assigned to other genera; whilst a considerable number of dextral Southern Indian and Ceylonese species, formerly classed under *Xesta* and *Hemiplecta*, or separated as *Cryptozona*, *Xestina*, or *Nilgiria*, are now united with the typical sinistral forms of *Ariophanta* into a single genus, the animals being very similar in their general anatomy.

[*Key to Species of* Ariophanta.

Section I. Typical, sinistral. (ARIOPHANTA.)]

A. Shell perforate or very narrowly umbilicated.
  a. Shell solid, not horny.
    a'. Radula with a narrow central band of only 17 median teeth; the left dorsal lobe divided into two distinct parts ..... *lævipes.*
    laidlayana.
    kadapaensis.
  b. Horny, brownish, more or less translucent.
    b'. Depressed.
      a''. Radula with broad central band of 35 to 55 teeth ..... *interrupta.*
      immerita.
      b''. Globose ..... *bajadera.*
      intumescens.
B. Shell openly and deeply umbilicated ..... *cysis.*
    Subsp. *dalyi.*
    thyreus.
    Subsp. *heteræa.*

Section II. Dextral. (CRYPTOZONA ?)

A. Colour uniform or nearly so, no spiral bands of colour.
  a. Decussated above.
    a'. Radula with broad band of median teeth; left dorsal lobe undivided ..... *semirugata.*
    belangeri.
  b. The whorls transversely striated, not decussated. *albata.*
    sisparica.
    novella.
    ceraria.
B. Shell spirally banded with colour more or less distinctly.
  a. Decussated but not grooved ..... *ligulata.*
    bistrialis.
    basilessa.
    gardeneri.

b. Sculpture of decussating lines and of oblique shallow grooves and low ridges ..... *basileus.*
beddomii.

c. Whorls transversely striated, without decussation or grooves ..... *chenui.*
juliana.
maderaspatana.
gassii.
solata.

I. Sinistrorse. (ARIOPHANTA.)

A. *Perforate or very narrowly umbilicated.*

a. *Not horny: banded spirally above, or white or brown throughout.*

[a'. *Radula with a very narrow band of median teeth. The left dorsal lobe divided.*]

51. **Ariophanta lævipes**, *Müll.* (Helix) *Hist. Ver.* ii, p. 22 (1774); *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 71; *id. t. c.* iii, 1853, p. 75; *id. t. c.* vii, 1876, p. 128; *Nev.* (Nanina-Ariophanta) *Hand-l.* i, 1878, p. 19; *Godwin-Austen, J. A. S. B.* xlix, 1880, p. 154, pl. 10, fig. 3 (animal); *id. Mol. Ind.* i, 1898, p. 133, pl. 33, fig. 7, pl. 34, fig. 1 (animal); ii, p. 81, pl. 80, fig. 5 (anatomy), pl. 82, fig. 4 (radula), p. 135.
Helix trifasciata, *Chemn., Mart. & Chemn. Syst. Conch.-Cab.* xi, p. 308, pl. 213, figs. 3018–19 (1795); *Pfr. Mon. Hel.* iii, 1853, p. 76; *id. t. c.* vii, 1876, p. 128; *H. & T. C. I.* 1876, pl. 131, fig. 4.

Shell depressed, rather thin, obliquely striated and decussated with fine spiral lines above, smooth beneath, white or whitish with three spiral chestnut bands; spire low, conoidal; whorls 5,

Fig. 18.—*Ariophanta lævipes.* ½.

slightly convex, the last rounded beneath, angulate at the periphery, the angulation generally disappearing near the mouth; aperture lunate, diagonal; peristome in one plane, simple above, slightly thickened and reflected below.

Major diam. 28, min. 23½, axis 15 mm. A large flat variety from Rajpipla measures 28½, 24½, and 13½.

Hab. Bombay (common in gardens); Rajpipla Hills, east of Surat. I have never been able to trace the occurrence of this species in Malabar.

The commonest variety is white with three spiral bands—one near the suture, one above and one beneath the periphery; but some shells have the ground-colour brownish with darker bands, and some are white or dark brown throughout. The parietal wall of the aperture and the area around the umbilicus (periomphalus) are never darker than the adjacent portion of the last whorl.

The teeth on the radula have the formula 120 . 2 . 8 . 1 . 8 . 2 . 120 (130 . 1 . 130): the rhachidian tooth is tricuspid; the eight inner laterals bicuspid and broad, forming a narrower median line than in other species of the genus, *i. e.* 17 teeth to 45 in the latter. The admedian teeth are bicuspid up to the 104th.

52. **Ariophanta laidlayana**, *Bs.* (Helix) *A. M. N. H.* (2) xviii, 1856, p. 253; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 31; *id. t. c.* vii, 1876, p. 96; *H. & T.* (Helix) *C. I.* 1876, pl. 58, fig. 3; *Nev.* (Nanina-Ariophanta) *Hand-l.* i, 1878, p. 18; *Godwin-Austen* (Helix-Ariophanta), *J. A. S. B.* xlix, 1880, p. 155, pl. 10, fig. 2 (animal); *id. Mol. Ind.* i, 1898, p. 140, pl. 34, fig. 3.

Similar to *A. lævipes*, except that the coloured spiral band close to the suture is wanting, and that the periomphalus or area around the perforation in the base and the parietal or inner wall of the aperture are always chestnut, contrasting with the rest of the wall. As a rule, too, the present species is less depressed and smoother. The coloration varies; specimens without bands are sometimes found, white or brown throughout.

Major diam. 28, min. 23, axis 15 mm.

Hab. The hill-country of Western and Southern Bengal, Orissa, &c., from the Ganges to south of the Godavari and west to about 80° E.

53. **Ariophanta kadapaensis.**

Helix nicobarica, *Chemn.*, *Mart. & Chemn. Syst. Conch.-Cab.* ix, 1, p. 79, pl. 108, figs. 911, 912 (1795); *Pfr. Mon. Hel.* i, 1847, p. 40; *id. t. c.* vii, 1876, p. 75; *Blf. J. A. S. B.* xxxviii, 1869, p. 139; *H. & T. C I.* 1876, pl. 52, fig. 1.

Nanina (Ariophanta) kadapaensis, *Nev. Hand-l.* i, 1878, p. 19; *Godwin-Austen, Mol. Ind.* i, 1898, p. 141.

Shell globose, obliquely striated, generally with fine impressed decussating spiral lines, dull chestnut above, with a white spiral band near the suture and another round the periphery, the inner borders of the white bands darker, a broad white area round the base, periomphalus and parietal wall of aperture dark; spire convexly conoid, apex blunt; whorls 5½, slightly convex, the last rounded at the periphery, swollen below; aperture diagonal, roundly lunate; peristome small, reflected at the perforation.

Major diam. 40, min. 35, axis 28 mm.

Hab. Cuddapah, Madras Presidency (*King*); Nullamullays, Kurnool (*Beddome*), not Nicobars.

b. *Horny, brownish, more or less translucent.*

b'. *Depressed.*

54. **Ariophanta interrupta,** *Bs.* (Helix) *P. Z. S.* 1834, p. 90; *id.* (Helix) *Zool. Jour.* v, p. 461 (1835); *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 63; *id. t. c.* vii, 1876, p. 125; *H. & T.* (Helix) *C. I.* 1876, pl. 27, fig. 3; *Godwin-Austen, J. A. S. B.* xlix, 1880, p. 154, pl. 10, fig. 1 (animal); *id. Mol. Ind.* i, 1898, p. 130, pl. 34, fig. 2; *Blf. Proc. Mal. Soc.* iv, 1901, p. 244.

Helix himalayana, *Lea, Obs.* i, 1831, p. 167, pl. 19, fig. 66; *Bs. A. M. N. H.* (3) xi, 1863, p. 88.

Shell flatly convex above, rather coarsely, obliquely, plicately striated and decussated with fine impressed lines, the decussation sometimes obsolete, more tumid and smoother beneath; brownish horny, darker below the periphery, and gradually becoming paler again beneath; whorls $4\frac{1}{2}$, convex above, the last angulate at the periphery; aperture roundly lunate, peristome thin.

Major diam. 26, min. $22\frac{1}{2}$, axis 16 mm. (Calcutta). A large depressed variety from Pareshnáth measures 32, 27, and 17. Animal pinkish grey.

Hab. Bengal, Behar, Orissa, Ganjam, Golconda Hills; Vizagapatam. Common in Calcutta [and extends to Jessore].

55. **Ariophanta immerita,** *Bl.* (Nanina-Ariophanta) *J. A. S. B.* xxxix, 1870, p. 17; *id. t. c.* xlix, 1880, p. 155, pl. 3, fig. 4; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 128; *H. & T.* (Helix) *C. I.* 1876, pl. 150, fig. 7; *Godwin-Austen, Mol. Ind.* i, 1898, p. 135, pl. 33, fig. 1 (1883), pl. 82, fig. 6 (radula).

The Western race *A. immerita* is smoother, with the spiral impressed lines nearly or quite obsolete. It has hitherto only been found in South Canara. According to Godwin-Austen, Moll. Ind. i, p. 135, the outer lateral teeth of the radula are more numerous in *A. interrupta* than in *A. immerita*, but this is scarcely a character that is necessarily of specific value. The number in *A. interrupta* is 40 . 23 . 1 . 23 . 40 (63 . 1 . 63), so that the median row of large teeth is very broad. In *A. immerita* it is 25 . 24 . 1 . 24 . 25 (49 . 1 . 49). The rhachidian tooth has a cusp on each side, the admedian teeth only one on the outer side; the smaller lateral teeth are pointed, without lateral cusps. [See fig. 17 B (p. 27) also for the jaw and dorsal lobes.]

b''. *Globose.*

56. **Ariophanta bajadera,** *Pfr.* (Helix) *Zeitschr. Mal.* 1850, p. 69; *Bens.* (Helix) *A. M. N. H.* (2) x, 1852, p. 350; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 52; *id. t. c.* iv, 1859, p. 250; *id. t. c.* vii, 1876, p. 370; *H. & T.* (Helix) *C. I.* 1876, pl. 3, fig. 5; *Godwin-Austen,*

Mol. Ind. i, 1898, p. 137; *id. t. c.* ii, 1876, pl. 82, fig. 8 (teeth of radula).

Helix ammonea, *Val., Desh. in Fér. Hist. Nat.* i, 1850, p. 197, pl. 37 A, fig. 1; *Pfr. Mon. Hel.* iii, 1853, p. 41; *id. t. c.* viii, 1877, p. 560.

Shell thin, translucent, pale greenish to brownish horny throughout, rather glossy, coarsely plicately striated above, almost smooth beneath; spire conoidal, apex obtuse, suture rather deep; whorls

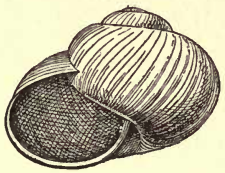


Fig. 19.—*Ariophanta bajadera.*

4–4½, convex, the last swollen, rounded at the periphery (immature shells are subangulate), descending slightly at the mouth; aperture diagonal, almost round, lunate; peristome thin, white.

Major diam. 27½, min. 22, axis 18½ mm.

Hab. The Bombay Presidency, south of the Narbudda, ranging east to Nagpur. Common on the Western Ghats near Bombay. Not found in Bengal. [Lives on leaves of one or two shrubs.—*W. T. B.*]

57. **Ariophanta intumescens**, *Blf.* (Nanina-Ariophanta) *J. A. S. B.* xxxv, 1866, p. 32; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 321; *id. t. c.* vii, 1876, p. 370; *H. & T.* (Helix) *C. I.* 1876, pl. 111, fig. 6; *Godwin-Austen* (Ariophanta), *J. A. S. B.* xlix, 1880, p. 155; *id. Mol. Ind.* i, 1898, p. 138.

A large duller shell than *A. bajadera*, thin, brown, with finer, less plicate striation, suture scarcely impressed; whorls 4½, almost flat above, the last bluntly angulate at the periphery, descending a little at the mouth; aperture large, rounded.

Major diam. 32, min. 26, axis 23 mm.

Hab. Mahableshwar (*W. T. B.*).

Teeth of radula 50 . 27 . 1 . 27 . 50 (77 . 1 . 77). The teeth are like those of *A. interrupta*, but the admedian series are tricuspid, there being a small tooth on the inner side as well as on the outer; lateral teeth very long and narrow, gradually becoming very small on the outer margin.

58. **Ariophanta canarica**, *Blf. Proc. Mal. Soc.* iv, 1901, p. 248, pl. 25, fig. 1.

Ariophanta intumescens, *Godwin-Austen, J. A. S. B.* xlix, 1880, pl. x, fig. 4 (animal).

Shell openly perforate, globosely turbinate, brownish horny, rather solid, closely and rugosely striated, the striæ decussated

above by fine subobsolete impressed lines ; spire conoid, apex subacute ; suture slightly impressed ; whorls 5, almost flat above, rapidly increasing, the last keeled at the periphery, descending beneath the keel towards the mouth, swollen beneath, somewhat compressed around the perforation ; aperture diagonal, rounded ; peristome in one plane, slightly thickened and a little expanded in adults, columellar margin broadly reflexed.

Major diam. 30, min. 24½, axis 21 mm.

Hab. S. Canara (*Beddome*).

This should perhaps be considered a race of *A. intumescens*, from which it is distinguished by smaller size, greater thickness, especially at the peristome, stronger decussated striation, higher and more acute apex, the presence of a keel, and a more open umbilicus. A small specimen measures 26, 21½, and 17½ mm. in the three dimensions.

B. *Openly and deeply umbilicated.*

59. **Ariophanta cysis**, *Bs.* (Helix) *A. M. N. H.* (2) ix, 1852, p. 404 ; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 92 ; *id. t. c.* iv, 1859, p. 174 ; *id. t. c.* vii, 1876, p. 277 ; *H. & T.* (Helix) *C. I.* 1876, p. 13, pl. 25, fig. 5 ; *Godwin-Austen, Mol. Ind.* i, 1883, p. 139 ; *id. t. c.* ii, 1898, pl. 82, fig. 7 (teeth of radula).
Helix auris, *Pfr. P. Z. S.* 1854, p. 286 ; *id. Mon. Hel.* iv, 1859, p. 173.
Helix cystis, *Rv. Conch. Ic.*, Helix, pl. 123, no. 737 (1852).
Helix ampullarioides, *Rv. t. c.* pl. 202, no. 1423 (1854).
Ariophanta dalyi (subsp.), *Blf. Proc. Mal. Soc.* iii, 1899, p. 280, figs. ; *Godwin-Austen, Mol. Ind.* ii, p. 128, pl. 98, fig. 4 (1899) (genitalia).

Shell globosely depressed, rather thin, obliquely striated, light yellowish brown ; spire convex, apex obtuse, suture slightly impressed ; whorls 4½, rapidly increasing, convex, the last swollen beneath, subangulate at the periphery, not descending near the mouth ; aperture diagonal, ovally lunate, the margins converging ; peristome thin, columellar margin reflected.

Major diam. 43, min. 35, axis 23 mm.

Hab. The typical form is from the western side of the Nilgiris (Sispara). *A. ampullarioides* is a higher and more globose form also from the Nilgiris, said to measure 42 mm. in major diameter by 26 in height. *A. dalyi* is a small, thin, dark shell from Hadur in Mysore, in some respects approaching *A. intumescens*. It has a whitish band round the periphery and measures 39, 32, and 22 mm. *A. cysis* has also been obtained by Beddome from the Anaimalais.

Teeth of radula of *cysis* 60 . 22 . 1 . 22 . 60. The admedians are bicuspid, having a cusp on the outer side ; only the rhachidian tooth is tricuspid, the laterals are aculeate. [In the genitalia the male organ is much simpler than in *A. lævipes*, although of the same type. The retractor muscle is given off from a stout long cæcum, con-

tinuous with the main sheath below. At the junction of these two parts is the kalc-sac on a very short tube which the vas deferens joins. It is thus strikingly similar to the same part in the genus *Ratnadvipia*.]

60. **Ariophanta thyreus**, *Bs.* (Helix) *A. M. N. H.* (2) ix. 1852, p. 405; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 251; *id. t. c.* vii, 1876, p. 454; *H. & T.* (Helix) *C. I.* 1876, pl. 27, fig. 6; *Blf. Proc. Mal. Soc.* iv, 1901, p. 244.
Helix ryssolemma, *Albers, Zeitschr. Mal.* 1852, p. 186; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 634; *id. Nov. Conch.* i, 1854, p. 37, pl. 10, figs. 13, 14.
Ariophanta heteræa (subsp.), *Blf. Proc. Mal. Soc.* iv, 1901, p. 248, pl. 25, fig. 2.

Shell depressed, rather more widely umbilicated than *A. cysis*, and distinguished from that species by having 5–5½ whorls increasing more slowly, so that the mouth is comparatively much smaller, and by the distinctly decussated sculpture above. The

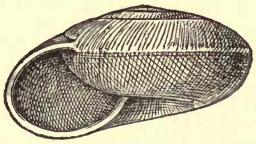


Fig. 20.—*Ariophanta thyreus.*

suture is scarcely impressed, except towards the mouth; spire low, convex. Colour brown horny, with generally a narrow dark rufous band below the subangulate periphery. The peristome is blunt and frequently thickened.

Major diam. 33, min. 28, axis 16 mm. A large specimen measures 40, 34, and 21 mm. Animal brownish grey, mantle paler.

Hab. Brahmageri (Coorg); Nilgiri, Anaimalai and Balarangam Hills, S. India.

Intermediate forms between this shell and *A. cysis* occur.

A. heteræa is one of these intermediate forms. It is less depressed and thinner than typical *thyreus*, and more narrowly umbilicated, the sutures are deeper and the sculpture not decussated. The colour is paler brown, and the narrow reddish band below the periphery is very distinct.

Major diam. 37, min. 30, axis 21 mm.

Hab. Sispara, west side of Nilghiris.

A. ryssolemma (*rhysolemma*) is a large variety with coarse sculpture, measuring 40, 33, and 19 mm. Specimens collected at Sispara Ghat, Nilgiri Hills, agree with the description.

II. Dextrorse. (CRYPTOZONA, XESTINA, or NILGIRIA.)

A. *Colour uniform or nearly so; no spiral bands of colour.*

a. *Decussated.*

a'. *Radula with broad band of median teeth. Left dorsal lobe undivided.*

61. **Ariophanta semirugata**, *Beck* (Galaxis), *Ind.* p. 42 (1837); *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 40; *id. t. c.* vii, p. 75; *H. & T.* (Helix) *C. I.* 1876, pl. 59, fig. 4; *Nev. Hand-l.* i, 1878, p. 51.

Helix globulus, *Mart. & Chemn. Syst. Conch.-Cab.* ix, 2, p. 126, pl. 130, figs. 1159–60 (1786); *nec Müll. Hist. Ver.* ii, p. 68 (1774).

Galaxis tranquebarica, *Fabr. MS.*, 1876, *Beck, l. c.* no descr.; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 41; *id. t. c.* vii, p. 75; *Stol.* (Helix) *J. A. S. B.* xli, 1872, 2, p. 212 (footnote); *Godwin-Austen* (Nilgiria), *Mol. Ind.* ii, p. 78, pl. 81 [figs. 3–3 *d*, animal, genitalia, with spermatophore; pl. 82, fig. 3, radula (1898)]; *id. t. c.* ii, p. 135 (1899) [pl. 94, figs. 5–5 *e*, spermatophore], pl. 98 [figs. 2–2 *b*, anatomy and sculpture].

Shell perforate, globose or globosely conoid to depressedly globose, pale brownish to whitish, finely decussated above with oblique striæ and spiral impressed lines, the latter sometimes faint or wanting; smoother below; suture very little impressed;

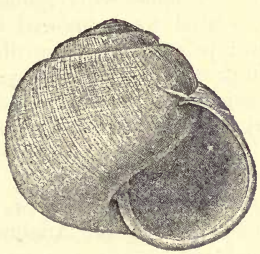


Fig. 21.—*Ariophanta semirugata.* ½.

whorls 5–6, slightly convex, the last large and swollen, generally descending near the mouth; aperture roundly or ovally lunate; peristome thin, reflected near the umbilicus.

Major diam. 33, min. 28, height 28 mm.

Hab. The greater part of the Peninsula of India from the Nerbudda and Son southwards, Cutch (*Stoliczka*); also in Northern Ceylon. Common in open country.

A very variable shell, the spire especially varying in elevation. An average specimen (figured) from Trichinopoly gives the measurements above quoted; others from the same place measure 37, 33, 34, and 33, 30, and 35 mm. Another measures 30, 25, 24.

A. semirugata is a thinner smoother variety; *A. tranquebarica* thicker, with stronger sculpture, and more globose.

Animal with a triangular right dorsal lobe to the mantle and a long narrow left dorsal lobe. Foot not divided.

In the genitalia distal portion of penis-sheath very long and convolute; the retractor muscle of the male organ is given off from an extremely long diverticulum. A cylindrical kalc-sac, about as long as the epiphallus. Spermatheca bulbous, on a short narrow neck. Dart-sac very large and long.

Radula with 54 . 3 . 17 . 1 . 17 . 3 . 54 (74 . 1 . 74) teeth in a row: rhachidian tooth tricuspid; the admedians close to the middle have a slight inner cusp, which soon disappears; the outer cusp is persistent on the admedians and on some of the laterals.

62. **Ariophanta belangeri**, *Desh.* (Helix) *in Bélanger, Voy. Zool.* p. 43, pl. 1, figs. 1–3 (1834); *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 69; *id. t. c.* vii, 1876, p. 172; *H. & T.* (Helix) *C. I.* 1876, pl. 29, fig. 6.

Helix bombayana, *Grat. Act. Soc. Lin. Bord.* xi, 1841, p. 406, pl. 1, fig. 1; *Pfr. Mon. Hel.* i, 1847, p. 41; *id. t. c.* iii, 1853, p. 76; *id. t. c.* vii, 1876, p. 125; *H. & T.* (Helix) *C. I.* 1876, pl. 29, fig. 5; *E. A. Smith* (Xestina), *Faun. Geog. Mald. Lac. Is.* 1902, p. 142.

Helix vitellina, *Pfr. P. Z. S.* 1848, p. 109; *id. Mon. Hel.* iii, 1853, p. 72; *id. t. c.* vii, 1876, p. 122; *H. & T.* (Helix) *C. I.* 1876, pl. 59, figs. 1, 2.

Shell openly perforate, depressedly globose, obliquely striated, and more or less decussated by impressed lines (often obsolete) above, smoother below; pale tawny to purplish or whitish; spire low, convex, suture impressed; whorls 5–5½, convex, the last much smaller than in *A. semirugata*, scarcely descending in front, subangulate at periphery; aperture roundly lunate; peristome thin, basal and columellar margins slightly reflected.

Major diam. 46, min. 37, axis 28 mm.

Hab. Madura, South Arcot, and Malabar, and probably all the southernmost part of the peninsula. Anaimalai Hills; N. Mahlor Atoll, Maldives (introduced).

The recorded locality Bombay is very doubtful.

The dimensions above given are those of typical *A. belangeri*, from Madura: *vitellina* is a small variety, measuring 29, 24, and 18 mm.; *bombayana* still smaller (28, 23, 16); on the other hand, a very large shell from Gingi, South Arcot, measured no less than 52, 44, and 31 mm.

A. belangeri may generally be distinguished from *A. semirugata* by more depressed form, less swollen last whorl, and smaller aperture. Intermediate forms occur.

b. *The whorls transversely striated, not decussated.*

63. **Ariophanta albata**, *Blf.* (Xestina) *J. A. S. B.* 1880, pt. 2, p. 189, pl. 3, fig. 3; *id. Proc. Mal. Soc.* iv, 1901, p. 245.
Helix lucublanda, *Ancey, Le Nat.* iii, 1886, p. 293.

Near *A. belangeri*, but thicker and more coarsely sculptured with rather irregular oblique impressed grooves; no decussating spiral lines; the colour is white throughout. The shell is intermediate in form between *A. belangeri* and *A. maderaspatana*.

Major diam. 29, min. 32½, height 17½.

Hab. Papanassam, in the hills west of Tinnevelly, S. India (*Beddome*).

64. **Ariophanta sisparica**, *Blf.* (Nanina-Hemiplecta?) *J. A. S. B.* 1866, 2, p. 34; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 122; *H. & T.* (Helix) *C. I.* 1876, pl. 112, figs. 4, 5, 6.

Shell narrowly umbilicated, depressed, rather thin, striated, white, with a straw-coloured epidermis, having a dull oily lustre; spire convex, low, suture flat, linear, submarginate; whorls 4½, flatly convex above, the last not descending, bluntly angulate at the periphery, more swollen and convex beneath; aperture oblique, subovally lunate, white and pearly inside; peristome thin, margins united by a thin callus, columellar margin curved, briefly reflected.

Major diam. 37, min. 30, axis 18 mm.; aperture 19 broad, 16 high.

Hab. Sispára Ghat, Nilgiri Hills, about 6000′.

I obtained two specimens of this species in 1864 on the road leading down to Sispára Ghat.

65. **Ariophanta novella**, *Pfr.* (Helix) *P. Z. S.* 1854, p. 50; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 34; *Rv.* (Helix) *Conch. Ic.* no. 1294; *H. & T.* (Helix) *C. I.* 1876, pl. 150, fig. 8.

Shell obtectly perforate, turbinately depressed, almost lenticular, carinate, rather thin, pale horny, striated, not decussated; spire low, conoid, with the sides slightly convex, suture almost flat; whorls 5, nearly flat above, the last convex beneath, sharply keeled, the keel growing blunt near the mouth; aperture oblique, subtetragonally lunate; peristome thin, columellar margin curved above, almost vertical, briefly reflexed, and partly covering the perforation.

Major diam. 21, min. 17, axis 10 mm.

Hab. Ceylon (*Thwaites*).

An apparently rare shell, and confined to the hills of South-western Ceylon. The colour may be darker when fresh, as shown in Reeve's figure.

66. **Ariophanta ceraria**, *Bs.* (Helix) *A. M. N. H.* (2) xii, 1853, p. 91; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 67; *H. & T.* (Helix) *C. I.* 1876, pl. 28, fig. 4.

Shell obtectly perforate, depressed, waxy white to pale fulvous

horny, with a dull resinous lustre, plicately striated, sometimes more or less undulated transversely to the whorls above, and decussated by fine subdistant impressed lines, occasionally obsolete, smoother below; spire convex, suture not impressed; whorls $4\frac{1}{2}$–5, rather rapidly increasing, almost flat above, the last more convex, keeled at the periphery, the keel often disappearing near the mouth, convex below, the convexity below the keel deeper than the spire is high; aperture oblique, subovally lunate; peristome thin, columellar margin curved, briefly reflexed, nearly covering the perforation.

Major diam. 22, min. 18, axis 11 mm.

Hab. The higher ranges of South-western Ceylon; Horton Plains (*Layard*); Mt. Pedro Talla Galla, above Newara Eliya (*H. Nevill*).

[The anatomy is exactly like that of *A. chenui* and the radula has the same formula (see p. 44). The two species have very close relationship. *A. chenui*, however, is from a lower altitude, ranging to the coast-line; whereas *ceraria* is from the higher ranges of Ceylon (*H. B. Preston*), a difference of conditions quite sufficient to have brought about dissimilarity in the shells.]

The figures of this shell by Reeve and Hanley are poor. The shape resembles that of *A. bistrialis*. *A. novella* is more closely wound and the sculpture is different.

B. *Shell spirally banded with colour more or less distinctly.*

a. *Decussated but not grooved.*

67. **Ariophanta ligulata**, *Fér.* (Helix) *Hist. Nat.* pl. 31, fig. 2 (1819–21); *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 71; *id. t. c.* vii, 1876, p. 122; *H. & T.* (Helix) *C. I.* 1876, pl. 28, fig. 9; *Nev.* (Nanina–? Xesta) *Hand-l.* i, 1878, p. 50; *Godwin-Austen* (Helix), *J. A. S. B.* xlix, 1880, p. 158, t. 11, fig. 3 (animal); *id.* (Nilgiria) *Mol. Ind.* ii, 1899, p. 123, pl. 98, figs. 1–1 *d* (animal, genitalia, and sculpture).

? Nanina turbinata, *Beck, Ind. Mol.* p. 4 (1837, no descr.); *Mörch* (Cryptozona), *Jour. Conch.* xx, 1872, p. 335; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 90.

Shell narrowly perforate, depressedly globose, finely marked with rather flexuous plicate striation, faintly decussated with subdistant impressed lines, whitish, generally brownish above the periphery and inside each suture, the dark colour forming a spiral band with an indistinct inner border; spire depressedly conoid, varying in height, apex acute, suture impressed; whorls $5\frac{1}{2}$–$6\frac{1}{2}$, slightly convex, regularly and slowly increasing, the last subangulate at the periphery, convex beneath; aperture oblique, lunate; peristome simple, thin, slightly reflected at the base and near the umbilicus.

Major diam. 26, min. 23, height 17 mm.

Hab. The eastern portion of Peninsular India; known localities are Patna, Bhágalpur (on the Ganges), Mánbhum, Cuttack, Madras, and other places in the Carnatic. Except in the height of the spire, there is but little variation.

68. **Ariophanta bistrialis**, *Beck* (Nanina), *Ind. Mol.* i, p. 2 (1837, descr.); *Pfr. in Chemn.* ed. 2, 1846, Helix, no. 61, pl. 11, figs. 10, 11; *id.* (Helix) *Mon. Hel.* i, 1847, p. 71; *id. t. c.* vii, 1876, p. 122; *H. & T.* (Helix) *C. I.* 1876, pl. 29, fig. 1; *Godwin-Austen* (Nilgiria), *Mol. Ind.* ii, 1898, p. 80, pl. 81, fig. 4 (genitalia), pl. 82, fig. 5 (radula).

Helix ceylanica, *Pfr. Zeitschr. Mal.* 1850, p. 67; *id. Mon. Hel.* iii, 1853, p. 71; *id. t. c.* vii, 1876, p. 122; *H. & T. C. I.* 1876, pl. 29, fig. 3; *Godwin-Austen* (Nilgiria), *Mol. Ind.* ii, 1898, p. 126 [(description of animal, genitalia, and radula)].

Helix taprobanensis, *Dohrn, Mal. Bl.* vii, 1859, p. 206; *Pfr. Mon. Hel.* v, 1868, p. 116; *H. & T. C. I.* 1876, pl. 29, fig. 2.

? Helix cyix, *Bs. A. M. N. H.* (3) v, 1860, p. 382; *Pfr. Mon. Hel.* v, 1868, p. 236; *H. & T. C. I.* 1876, pl. 29, fig. 4.

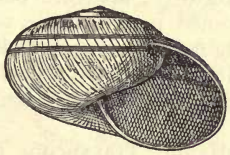


Fig. 22.—*Ariophanta bistrialis.*

Shell perforate, subglobosely depressed, thin, finely striated, decussated above with impressed spiral lines, polished below, pale horny, encircled by two rufous lines (one or both sometimes wanting), with a whitish band between them, the upper line continued inside the suture on the upper whorls; spire low, convex; whorls 4½, nearly flat, rapidly increasing, the last not descending, convex beneath; aperture large, oblique, lunately ovate; peristome thin, with the columellar margin slightly reflected.

Major diam. 30, min. 25, axis 17 mm.; aperture 16 broad and 16 high.

Hab. Madras Presidency and Ceylon. I found this shell as far north as the Gadávari at Dumagudiam, but I have seen no specimens from the Malabar coastland. Large specimens up to 40 mm. in size have been obtained on the Shevroy Hills by Mr. J. R. Henderson.

The usual South-Indian form (*bistrialis*) is pale-coloured and smooth with two rufous lines; the common Ceylon form is darker in colour with a single line (*ceylanica*); but both varieties occur in each area, and also shells without any bands: *taprobanensis* is a large rather thick variety from Ceylon; *cyix* is a dwarf form, rather globose, generally with the colour-lines faint or wanting, from Matelle. I have also a specimen from Trincomali.

Teeth in radula of *A. bistrialis* 50 . 2 . 17 . 1 . 17 . 2 . 50 (69 . 1 . 69); of the var. *ceylanica* 62 . 2 . 19 . 1 . 19 . 2 . 62 (83 . 1 . 83). The inner or admedian laterals, like the rhachidian, are tricuspid, gradually losing the side cusps; outer laterals aculeate.

69. **Ariophanta basilessa**, *Bs.* (Helix) *A. M. N. H.* (3) xv, 1865, p. 11; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 244; *H. & T.* (Helix) *C. I.* 1876, pl. 25, fig. 2, pl. 52, fig. 4.
Hemiplecta tinostoma, *Blf. J. A. S. B.* xlix, 1880, p. 187, pl. 3, fig. 1.
Hemiplecta enisa, *Blf. t. c.* p. 188, pl. 3, fig. 2.

Shell narrowly umbilicated, depressed, thick, covered with a yellowish-brown epidermis, beneath the epidermis pale purplish, with a narrow whitish band above the periphery, darker and browner below the band: sculpture subgranular, formed by striæ of growth decussated by close, fine, slightly flexuous impressed lines; spire convex, low, suture slightly impressed, more so near the mouth; whorls $4\frac{1}{2}$, the upper nearly flat, the last more convex above, moderately tumid below, rounded at the periphery, scarcely or not descending anteriorly; aperture oblique, oblong-ovately lunate; peristome thickened in old shells, especially at the basal margin, columellar margin oblique, reflected, partly covering the umbilicus and terminating abruptly in a small point.

Major diam. 45 (a large shell 53), min. 38, axis 24 mm.; mouth 23 broad, 17 high.

Hab. Hills near Kottyam, Travancore (*Day*), Pulneys and Anaimalais, 7000′ (*Beddome*). Not known north of the Pálghát Gap.

A. tinostoma is much depressed, with an elongate mouth, having the upper and basal margins parallel and the last whorl broad near the aperture and subangulate at the periphery.

Major diam. 49, min. 40, axis 21 mm.; aperture 26 broad and 18 high.

A single specimen was obtained on the Tinnevelly Ghats, east of Papanassam, at 5000 feet elevation, by Col. Beddome.

A. enisa was found, also by Col. Beddome, at an elevation of 6000 feet on the top of Aghastyamalai, a hill near Cape Comorin, between Tinnevelly and Travancore. It is smaller and less thick than typical *A. basilessa*, and the aperture is less elongate.

Major diam. 46, min. 38, axis 23 mm.; aperture 24 broad, 19 high.

These two forms look very different at first, but they are, I think, varieties of *A. basilessa*, which, if they are included, inhabits the Travancore hills generally; *A. enisa*, as noticed under *A. chenui*, passes into that species.

Ariophanta gardeneri, *Pfr.** (Helix) *Mart. & Chemn. Conch.-Cab.* ed. 2, 1846, Helix, no. 703, pl. 112, figs. 12, 13; *id.* (Helix) *Mon. Hel.* i, 1847, p. 47; *id. t. c.* vii, 1876, p. 87; *H. & T.* (Helix) *C. I.* 1876, pl. 84, fig. 7.

Shell subobtectly perforate, turbinate, solid, yellowish brown to dull chestnut, with a narrow pale band round the periphery, subcostulately striated, with a few decussating spiral lines at considerable regular intervals, these lines, formed of raised points on the striæ, are continued to the epidermis but are often wanting;

* Transferred to *Euplecta*, after dissection of the animal: *vide* p. 64.

spire conoidal, apex acute, suture impressed; whorls $6\frac{1}{2}$, convex, the last rounded at the periphery, not descending; aperture oblique, roundly lunate; peristome simple, blunt, the basal margin rather thicker, columellar margin briefly produced and reflected, nearly covering the perforation.

Major diam. 21, min. 19, axis $14\frac{1}{2}$ mm.; aperture 10 broad, 9 high.

Hab. Hills of South-western Ceylon, about 4000 feet elevation, in forest (*Gardener*, *Nevill*).

[From beneath fallen leaves in forest, Uva, 5000 ft. (*O. Collett*).]

[For description of animal, see p. 64.]

b. *Sculpture of decussating lines and of oblique shallow grooves and low ridges.*

70. **Ariophanta basileus**, *Bs.* (Helix) *A. M. N. H.* (3) vii, 1861, p. 81; *id. t. c.* xiii, 1864, p. 497; *Blf.* (Nanina) *J. A. S. B.* 1866, 2, p. 39; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 120; *id. t. c.* vii, 1876, p. 124; *H. & T.* (Helix) *C. I.* pl. 25, fig. 7; *Godwin-Austen* (Nilgiria), *Proc. Mal. Soc.* v, 1902, p. 248, pl. 6 (animal and anatomy).

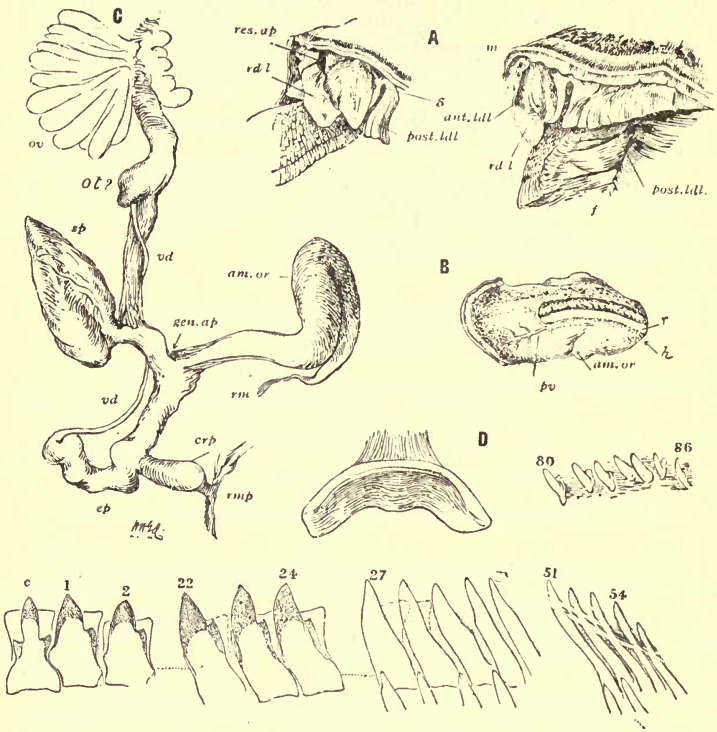
Helix titanica, *Pfr. P. Z. S.* 1862, p. 117, pl. 12, fig. 3.

Shell narrowly umbilicated, conoidly depressed, covered with a brownish-yellow deciduous epidermis, beneath the epidermis white, pinkish towards the apex, surrounded beneath the periphery by a broad dark chestnut or blackish band, which is paler below; sculpture consisting of striæ covered by a few impressed spiral lines and of irregular, shallow, slightly oblique grooves, often more or less obsolete; spire convexly conoid, apex obtuse, suture scarcely impressed; whorls $5\frac{1}{2}$, almost flat above, the last not descending, convex beneath, angulate at the periphery; aperture oblique, ovally lunate; peristome thin, straight, columellar margin expanded and briefly reflexed, partly covering the umbilicus.

Major diam. 72, min. 62, axis 38 mm.; aperture 38 broad, 16 high.

Hab. Anaimalai teak-forest, 2000–3000 feet above the sea, west of the main range of hills.

A. basileus is the largest of Indian snails. It has not been found north of the great gap in the Sahyádri range at Pálghát. The shell is very similar to that of the Siamese *Hemiplecta distincta*, Pfr., but the animal, for a specimen of which I am indebted to Mr. Thurston, proves on examination to be a true *Ariophanta*. The genitalia resemble those of *A. solata*. The radula is very broad and the formula for the teeth 56 . 2 . 28 . 1 . 28 . 2 . 56 (86 . 1 . 86), [which is almost identical with that of *A. chenui*. The centre tooth is tricuspid, the admedian teeth are elongate with a cusp on the outer side; the laterals are aculeate, slightly curved in form, they become shorter and more slender, and the outermost are blunt and minute, resembling those of *Ravana politissima*].



[Fig. 23.—*Ariophanta basileus.*

A. Mantle-margin (*m*), showing dorsal lobes. *s*, slit between the anterior and posterior lobes; *f*, foot, sole of.
B. Animal, shell removed, viewed from left side, showing (*r*) renal organ and position of heart (*h*) and amatorial organ within the visceral sac; also the pulmonary vein (*pv*).
C. Generative organs, separated out. ×2·3.
D. Jaw and teeth of the radula at various points in the row.

For explanation of letters in italics and numbers see figs. 2, 3, 4, and 16.]

71. **Ariophanta beddomii,** *Blf.* (Hemiplecta) *A. M. N. H.* (4) xiv, 1874, p. 406; *H. & T.* (Helix) *C. I.* 1876, pl. 159, fig. 10.

Similar to *A. basileus,* of which the present species may be a variety, but smaller, thinner, and more depressed. The sculpture and coloration are identical with those of some forms of the larger shell.

Major diam. 51, min. 41, axis 24 mm.; aperture 26 broad by 21 high.

Hab. Travancore Hills, west side, south of Peermede.

72. **Ariophanta (Xestina) chenui**, *Pfr.* (Helix) *Zeitschr. Mal.* 1847, p. 145; *id.* (Helix) *Mon. Hel.* i, 1847, p. 438; *H. & T.* (Helix) *C. I.* 1876, pl. 25, fig. 1, pl. 27, fig. 4; *Nev.* (Nanina-Hemiplecta) *Hand-l.* i, 1878, p. 47; *Godwin-Austen* (Nilgiria), *Mol. Ind.* ii, 1898, p. 124, pl. 96, figs. 1–9 (animal and anatomy), pl. 98, fig. 3 (sculpture).
Hemiplecta simoni, *Jousseaume, Mém. Soc. Zool. Fr.* vii, p. 282 (1894).

Shell openly perforate, depressed, rather thin, fulvous, with a narrow pale band, often indistinct, above the periphery, and a darker, ill-defined, rufous-brown band, fading away beneath, below the same; sculpture decussated, striæ of growth and impressed spiral lines occurring throughout, the upper surface of the last whorl marked with shallow, irregular, slightly oblique ridges and furrows, resembling hammer-marks on metal; spire low, convex, suture slightly impressed, more towards the mouth; whorls $4\frac{1}{2}$, flattish above, the last more convex, slightly angulate at periphery, more swollen below; aperture oblique, ovately lunate; peristome slightly thickened.

[The right shell-lobe is represented by a very small flap, situated near the respiratory aperture; this flap is an expansion on the dividing line of the dorsal lobe and narrows backward towards the posterior margin of the mantle-zone, which, on the body-whorl side and viewed from the inside (that is, the surface next the shell), is seen to form a distinct band with an equal breadth of $2\frac{1}{2}$ mm. contracted. Compare this also with the right shell-lobe of *Ratnadvipia* and *Ariophanta ligulata*. The left shell-lobe is also a narrow fillet overlapping the peristome, 2 mm. broad, but it has no tongue-like process on the left margin. The right dorsal lobe is triangular and ample. The left dorsal lobe is in two distinct parts, the anterior being the largest, and it distinctly overlaps the smaller narrower posterior lobe; in this respect it differs from typical *Nilgiria solata* and other species of the genus, where no division of this lobe is found, and yet it is not division of the same kind as is seen in *Ariophanta lævipes*, &c.

The generative organs are very similar to those of *Nilgiria solata*.

The central and median teeth have large cusps on both sides. At the 20th tooth the cusps become very small, at the 23rd the inner disappears, and at the 25th there is no trace of the outer; the laterals are aculeate, the marginals are short and bicuspid to straight and blunt. The jaw has a flat convexity on the cutting-edge.]

Major diam. 44, min. 36, axis 21 mm.; aperture 23 broad, 18 high.

Hab. Hills of S.W. Ceylon; Matelle (*Layard*), Kandy (*Beddome*), Ambagamuwa District (*Collett*).

The chestnut band below the periphery is sometimes narrow, sometimes broader. The eggs are described by Collett as oval, pointed at the ends, 8 mm. long and 4 wide, white, soft (uncalcified),

and sulcated longitudinally. Teeth of radula 58 . 1 . 25 . 1 . 25 . 1 . 58 (84 . 1 . 84).

A shell, of which there are in the British Museum three specimens, collected by Mr. Thwaites, probably near Kandy, has been identified by Pfeiffer as a variety of the present species. The sculpture is, however, finely decussate, without the characteristic furrowed markings of *A. chenui*, and the shells are scarcely distinguishable from the Travancore variety or subspecies of *A. basilessa* already described (p. 40) as *A. enisa*.

Hemiplecta simoni is founded on the variety with a slightly raised spire represented in pl. 27, fig. 4 of Hanley and Theobald's 'Conchologia Indica.'

c. *Whorls transversely striated, without decussation or grooves.*

73. **Ariophanta (Xestina) juliana**, *Gray* (Nanina), *P. Z. S.* 1834, p. 58; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 44; *id. t. c.* vii, 1876, p. 79; *H. & T.* (Helix) *C. I.* 1876, pl. 52, fig. 7.
Helix ganoma, *Pfr. P. Z. S.* 1853, p. 124; *id. Mon. Hel.* iv, 1859, p. 22; *id. t. c.* vii, 1876, p. 79; *H. & T. C. I.* 1876, pl. 111, figs. 4–7.

Shell openly perforate, depressedly turbinate to conoidly depressed, solid, smooth, striated, without decussating spiral lines, pale straw-coloured to pink, with a narrow brown or

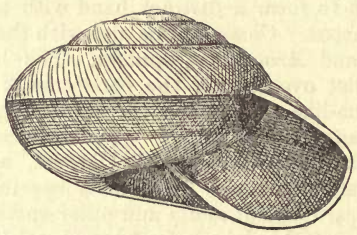


Fig. 24.—*Ariophanta juliana.*

chestnut spiral band below the suture, another, much broader, below the periphery, and a circular brown area around the umbilicus; spire convexly conoid, apex blunt, suture slightly impressed; whorls 5, slightly convex above, the last subangulate at the periphery, moderately swollen below, not descending; aperture oblique, broadly lunate; peristome simple, straight, blunt, columellar margin produced and dilated, partly covering the perforation.

Major diam. 48, min. 41, axis 27 mm.; aperture 24 broad, 20 high.

Hab. South-western Ceylon.

The typical form is rosy pink banded with chestnut. *H. ganoma* is a straw-coloured variety with brown bands, and generally more depressed. The type of *H. ganoma* measured 51, 41, and 26 mm. in the three dimensions; a smaller specimen gives 41, 34, and 20.

This variety has been recorded from Bentota (*Nevill*) and Cotta, near Columbo (*Collett*), both at the sea-level.

[The animal of a specimen from Cotta, Ceylon, is externally like that of *A. ligulata*, and, as in that species, there is not the slightest sign of a right shell-lobe. The left dorsal lobe is continuous, but a slight slit with overlap occurs on it at 16 mm. from the respiratory orifice; this may also be observed in *A. chenui*. This lobe is very narrow for its whole length. The genitalia are typical of the genus *Ariophanta*. Penis with a long retractor cæcum, a small sessile spermatheca; the amatorial organ long, bent on itself, with a large blunt point.

The teeth of the radula are similar to those of *A. chenui*:

55 . 1 . 27 . 1 . 27 . 1 . 55
83 . 1 . 83]

74. **Ariophanta maderaspatana**, *Gray* (Helix), *P. Z. S.* 1834, p. 67; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 63; *id. t. c.* iv, 1859, p. 54; *id. t. c.* vii, 1876, p. 118; *H. & T.* (Helix) *C. I.* 1876, pl. 28, fig. 2.

Shell openly perforate, depressedly globose, thin, rugosely striated, dull brownish rufous above, passing into white on the inner side of each whorl, paler or whitish beneath, generally with a white or whitish band round the periphery, occasionally whitish

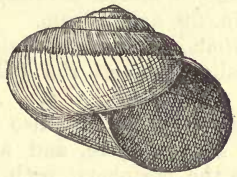


Fig. 25.—*Ariophanta maderaspatana.*

horny throughout, sometimes dark rufous speckled with white; spire depressedly convex; whorls 5½, convex, the last rather more swollen, not subangulate at the periphery in adults; aperture oblique, roundly lunate; peristome simple, thin, very slightly expanded, the reflected portion increasing in breadth near the perforation.

Major diam. 32, min. 26, axis 19 mm.

Hab. The higher parts of Mysore, the Nilgiris, Kolamalais, Shevroys, and locally at lower elevations, as on Chittycolum Hill, north of Trichinopoly, at about 1500 feet above the sea.

An almost uniformly coloured isabelline variety, with more convex whorls and impressed suture, occurs above 6000 feet on the Nilgiri and Palni Hills, and has in the first-named locality a black mantle and the body light tawny. This is var. β of Pfeiffer. The common form has both animal and mantle grey.

[Specimens from the Palni Hills have the mantle of the same colour as the rest of the body. The right dorsal lobe is triangular in shape, the left broad and continuous from the respiratory orifice up to the umbilical region as in *A. solata* and *tranquebarica*.

The male organ has a long cæcum, to which the retractor muscle is attached, and a short kalc-sac. Spermatophore like that of *A. tranquebarica*. Spermatheca small, globose, on a short stalk. A very large stout cylindrical amatorial organ.

The centre and admedian teeth of the radula are tricuspid as in *bajadera*; the lateral teeth have the outer cusp much below the point, which gradually becomes very small, so that the outermost appear to be nearly aculeate. The formula is

38 . 1 . 21 . 1 . 21 . 1 . 38
60 . 1 . 60]

75. **Ariophanta gassii**, *Blf.* (*Beddome MS.*) *Proc. Mal. Soc.* iv, 1901, p. 249, pl. 25, fig. 3.

Shell subobtectly perforate, depressedly globose, thin, rugosely striated, dark fulvous to pale chestnut above, with usually a dark rufous band above the periphery, sharply contracted with a whitish peripherial band, more or less defined; spire low, conoidly convex, suture impressed; whorls 6, convex, the last broader, not descending, subangulate at the periphery, convex beneath; aperture oblique, subovally lunate; peristome in mouth white, slightly obtuse, columellar margin oblique, very slightly curved, scarcely expanded till close to the umbilical region, where it is abruptly and rather broadly reflexed, almost covering the perforation.

Major diam. 36, min. 29, axis 21 mm.

Hab. Travancore Ghats, Anaimalais, Pulneys, and perhaps the higher ranges generally between the Pálghát Gap and Cape Comorin.

Immature specimens of a variety, also from the Travancore Ghats, have a lower convex spire, and a well-defined narrow white band just above the periphery, with a dark rufous border beneath, which fades gradually into the pale lower surface. Another variety appears to be indicated by a somewhat depressed specimen from the Pulneys in the British Museum.

This shell is distinguished from *A. maderaspatana* by rather larger size, narrower perforation, subangulate periphery, darker and more uniform coloration, and by the form of the peristome. The columellar margin in *A. maderaspatana* is slightly expanded throughout, and the amount of expansion increases gradually at the perforation, whilst in *A. gassii* there is scarcely any expansion till close to the perforation, where the margin is abruptly reflexed. It is, however, by no means improbable that the two pass into each other. A variety of *A. maderaspatana* which occurs in open ground on the plateau of the Nilgiris should perhaps be referred to *A. gassii*. It is distinguished by the dark colour of the animal and shell, the mantle being black.

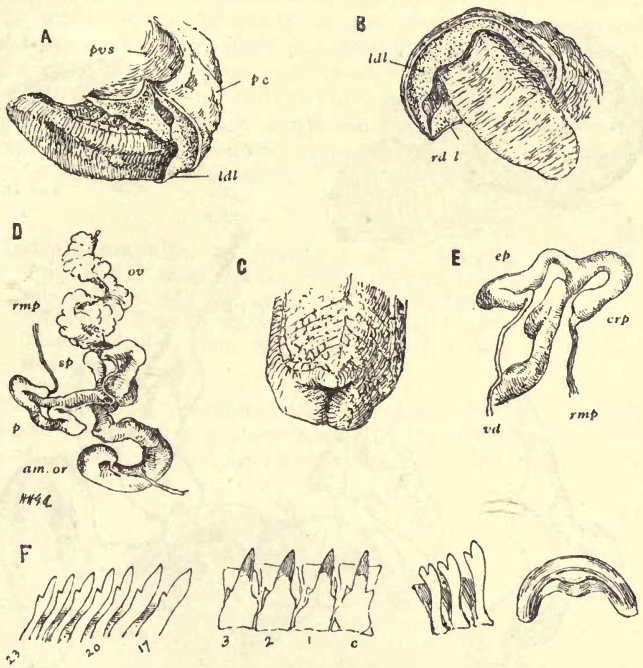
76. **Ariophanta solata**, *Bs.* (Helix) *A. M. N. H.* (2) ii, 1848, p. 159; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 67; *id. t. c.* iv, 1859, p. 170; *id. t. c.* vii, 1876, p. 274; *H. & T.* (Helix) *C. I.* 1876, pl. 28, fig. 6; *Godwin-Austen* (type of Nilgiria), *Mol. Ind.* ii, 1898, p. 77, pl. 80, figs. 1–4 (anatomy), pl. 82, fig. 2 (radula).

Shell perforate, subglobosely depressed, smooth, striated,

thicker than *maderaspatana*, white, often with a bluish tinge, washed with brownish on the last whorl, with a narrow, spiral, rufous band inside the suture and traces of other bands, and with numerous small, brownish, translucent spots irregularly distributed; spire very low; whorls $5\frac{1}{2}$, flatly convex above, the last slightly subangulate at the periphery, moderately swollen beneath; aperture oblique, lunately ovate, generally rufous within; peristome simple, thin, columellar margin reflexed.

Major diam. 26, min. 21, axis 15.

Hab. Nilgiris.



[Fig. 26.—*Ariophanta solata.*

A. Animal viewed from right side, showing edge of mantle- and dorsal lobes.
B. Animal viewed from left and front side, showing sole of foot.
C. Extremity of foot, showing mucous gland.
D. Generative organs.
E. Generative (male) organ.
F. Radula and jaw.

For explanation of letters in italics and numbers see figs. 2, 3, 4, and 16.]

[*Animal.* The right dorsal lobe is small, the left long, narrow, and continuous. Sole of foot not divided; in spirit puckered and wrinkled transversely. The mucous pore is overhung by a slight blunt process.

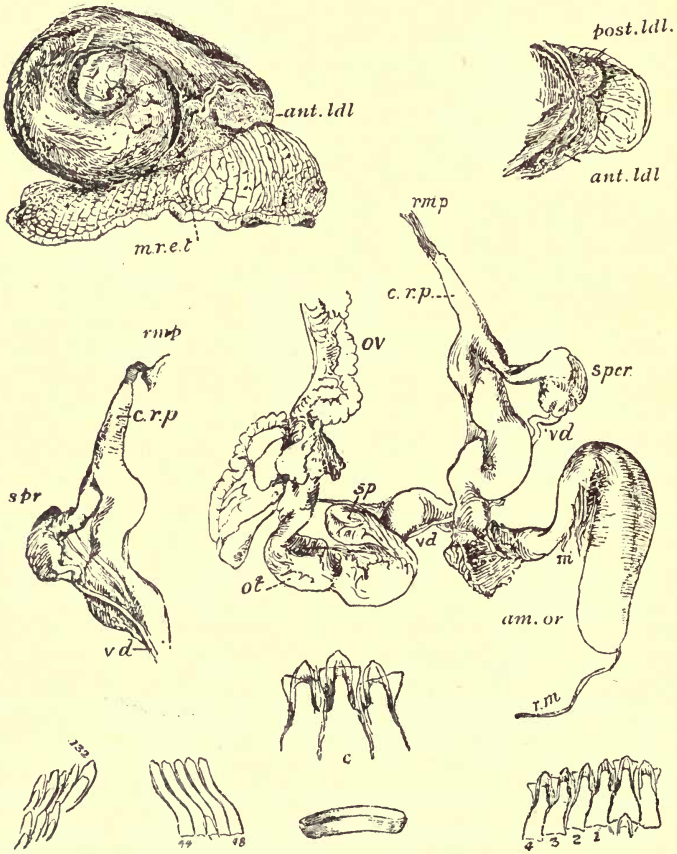
Peripodial line distinct, above a broad margin. In the generative organs the amatorial is solid and cylindrical with a retractor muscle; in the male organ there is a stout and long cæcum-like

process, at the head of which the retractor muscle is given off. The spermatheca is short and pear-shaped. The radula teeth are arranged: 35 . 2 . 15 . 1 . 15 . 2 . 35, or 52 . 1 . 52.

The central tooth is strongly tricuspid; the adjacent teeth are hardly tricuspid, only showing an exceedingly fine notch on some of the teeth on the inner upper margin; the laterals do not decrease much in size outwards and are evenly bicuspid.]

Subgenus **INDRELLA.**

Indrella, *Godwin-Austen, Proc. Mal. Soc.* iv, 1901, p. 187, pl. 18.



[Fig. 27.—*Indrella ampulla.*

Animal with shell removed from right side; head from above: ×0·8. The genitalia, ×1·8; the jaw and the teeth of the radula, ×144. *spr.* & *sper.*, spermatophore, position of; *m*, muscle attachments; *m.r.e.t*, muscle attachment of right eye tentacle, beneath integument.

For explanation of letters in italics and numbers see figs. 2, 3, 4, and 16.]

Type, *I. ampulla* (Bs.).

Range. Western slopes of Syhadri Range in Malabar.

Shell *Vitrina*-like, imperforate, with few whorls and a very large aperture.

Animal similar to that of *Ariophanta*, but larger, not fully retractile within the shell. Mucous pore of moderate size; no distinct overhangiing lobe or a small one. Sole undivided, very smooth. No shell-lobes; dorsal lobes well developed, the left divided into an anterior and a posterior part by a deep sinus. Kalc-sac small, receiving the vas deferens; retractor muscle attached to long straight cæcum given off at the junction of the flagellum of the male organ. Spermatheca oval, very short, on a short stem. Amatorial organ (dart-sac) stout and long. Jaw straight, with a slight convexity on cutting-edge, no median projection. Radula broad, with about 100 rows of teeth: 145 . 17 . 1 . 17 . 145; median tooth and the 17 on each side (admedians) long, broadly pointed, straight-sided, lateral cusps indistinct; laterals curved, aculeate, outer laterals bicuspid.

77. **Indrella ampulla**, *Bs.* (Helix) *A. M. N. H.* (2) v, 1850, p. 213; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 27; *id. t. c.* iv, p. 9; *id. t. c.* vii, 1876, p. 57; *Blf. J. A. S. B.* xxxiv, 1866, p. 39; *H. & T.* (Helix) *C. I.* pl. 25, fig. 4; *Nev.* (Nanina) *Hand-l.* i, 1878, p. 54; *Godwin-Austen, Proc. Mal. Soc.* iv, 1901, p. 187, pl. 18 [animal and anatomy].

Shell imperforate, obliquely ovate, globose, very thin, half the thickness consisting of epidermis, marked throughout with plicate lines of growth, crossed by faint impressed spiral lines, and on

Fig. 28.—*Indrella ampulla.*

the last whorl by shallow irregular furrows, brownish olive, sometimes darker brown; spire small, convex, obtuse; whorls $3\frac{1}{2}$, rapidly increasing, the last much larger, rounded at the periphery and beneath; aperture very large, oblique, roundly oval, the same colour within as without, but smooth and glossy; peristome thin, membranaceous, columellar margin much curved inwards.

Major diam. 50 (a large shell 63), min. 38, axis 30 mm.; aperture (obliquely) 32 broad, 30 high.

Hab. On the western slopes of the Wynaad, Nilgiri, and Anaimalai hills at moderate elevations (3000′).

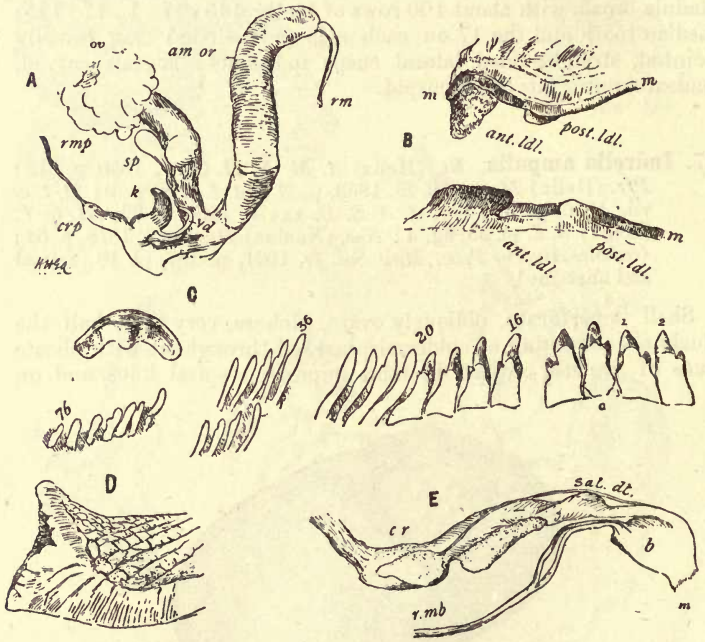
The animal, as represented in a drawing for which I am indebted to Sir Walter Elliot, is greenish yellow, but according to Col. Beddome it is black. It probably varies. Beddome found it feeding on large fungi.

Genus **RAVANA**.

Ravana, *Godwin-Austen, Proc. Mal. Soc.* iv, 1901, p. 261.

Type, *R. politissima* (Pfr.).

Range. South-western Ceylon.



[Fig. 29.—*Ravana politissima.*

A. Genitalia, detached. × 3.
B. Mantle-margin (*m*) viewed from the left side; lower figure from the underside, showing dorsal lobes. × 3.
C. Jaw and teeth of the radula from different parts of the row. × 244.
D. Extremity of foot with mucous gland. × 5·3.
E. Buccal mass and salivary glands; the latter are not in their natural position, owing to a twist in the intestine. *cr*, crop; *b*, buccal mass; *m*, mouth; *r.mb*, retractor of the buccal mass.]

Shell like that of *Macrochlamys*, perforate, depressed, thin, smooth, and horny.

Animal (of *R. politissima*) without shell-lobes; right dorsal lobe moderate, the left divided into a large anterior and a small posterior lobe with a wide interval between them. Sole narrow, undivided, truncated behind; mucous pore large, overhung by a large lobe. Kalc-sac short, curved, rather pointed at the free end, receiving the vas deferens at about one-third its length from the junction with the diverticulum leading to the retractor muscle; [retractor muscle attached to a cæcum;] penis-sheath short, distally to the junction sharply bent, the two segments of the bend held together by a muscular band; diverticulum stout, simple. Spermatheca very short. Amatorial organ (dart-sac) very large, much larger than penis. Jaw arched, with a median projection. Radula broad, with a broad median tract, the teeth-formula being 56 . 2 . 18 . 1 . 18 . 2 . 56 (76 . 1 . 76); rhachidian tooth broad, with a large cusp on each side, the 18 inner laterals or admedians each with a single well-marked cusp on the outer side; outer laterals narrow, long, aculeate, the outermost marginals very short.

The only species known was regarded as a *Macrochlamys* until the anatomy was examined. Possibly some other thin, horny, depressed shells from S. India or Ceylon belong to the present genus.

78. **Ravana politissima**, *Pfr.* (Helix) *P. Z. S.* 1853, p. 125; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 45; *H. & T.* (Helix) *C. I.* 1876, pl. 31, figs. 8, 9; *Godwin-Austen, Proc. Mal. Soc.* iv, 1901, p. 261, pl. 36.

Shell openly perforate, depressed, thin, polished, greenish or castaneous horny, striated beneath the epidermis, and marked with faint impressed spiral lines, not perceptible in fresh shells; spire low, obtuse, suture deeply impressed. Whorls $4\frac{1}{2}$–5, convex, regularly increasing, the last rounded, not descending; aperture slightly oblique, roundly lunate; peristome simple, nearly in one plane, thin, the margins converging, columellar reflected above.

Major diam. 24, min. 20, axis 11 mm.

Hab. The hills of South-western Ceylon, at an elevation of about 3000 feet; Pusilawe (*Layard*); Watawale (*Collett*).

Genus **EUPLECTA.**

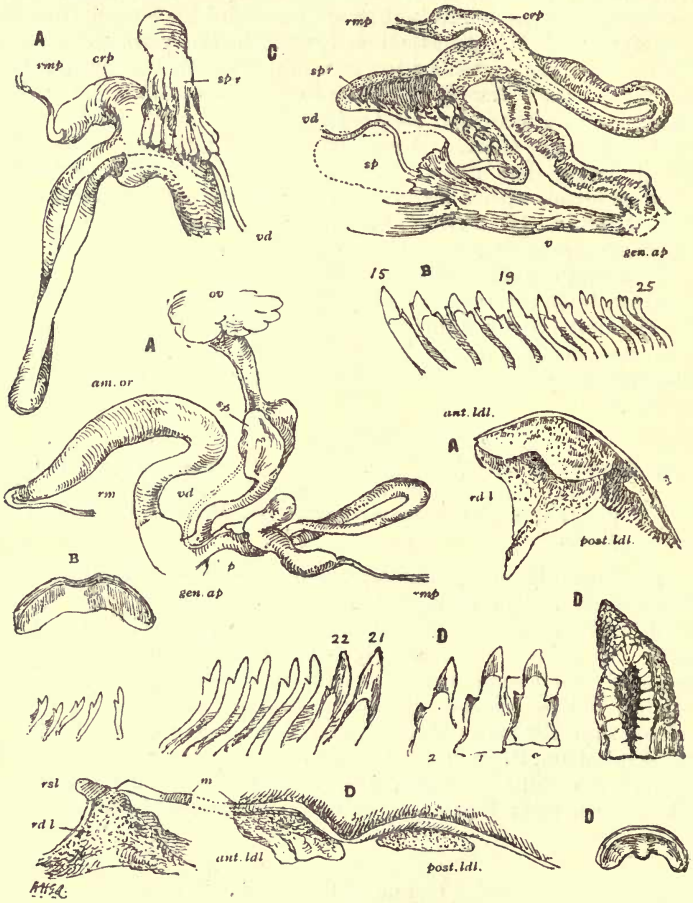
Euplecta, *Semper, Reise Phil., Wiss. Res.* iii, p. 14 (1870); *Godwin-Austen, Proc. Mal. Soc.* ii, 1899, p. 173; *id. Mol. Ind.* ii, 1898, p. 96, pls. 87, 97; *Blf. Proc. Mal. Soc.* iv, 1901, p. 246.

Type, *E. subopaca*, Pfr.

Range. The Indian Peninsula and Ceylon. Nearly all the species are confined to the neighbourhood of the western coast of India and the mountains of S.W. Ceylon.

Shell perforate (rarely imperforate), of moderate size, depressed turbinate, turbinate or trochiform, rather closely wound, generally

striated or costulate above, the ribbing decussated by impressed lines and in many species bearing rows of small moniliform tubercles; smoother below; peristome thin, columellar margin more or less reflected.



[Fig. 30.—A. *Euplecta partita*, p. 65. Genitalia, ×3·3; part of the male organ showing spermatophore forming near the junction of the vas deferens, ×6; and the dorsal lobes, × 3·3.

B. *Euplecta semidecussata*, p. 57. Jaw, × 6; transition and first lateral teeth of radula, × 146.

C. *Euplecta binoyaensis*, p. 62. Part of generative organs showing spermatophore in process of formation, × 9·4.

D. *Euplecta præeminens*, vide *travancorica*, p. 59. Shell- and dorsal lobes, × 3·3; jaw, × 6, and teeth of the radula, × 276; and the extremity of the foot, mucous gland with overhanging lobe, × 6.

For explanation of letters in italics and numbers see figs. 2, 3, 4, and 16.]

The shell differs, as a rule, from that of *Ariophanta* by having more whorls and being more closely wound, but there are exceptions. Most of the species are carinate.

Animal externally much like *Ariophanta*. A large mucous pore at the posterior extremity of the foot, sometimes with a small lobe above it. Shell-lobes generally wanting, the right sometimes present in a minute or rudimentary form; dorsal lobes moderate in size, the left in two parts. The sole indistinctly folded in the middle when contracted.

In the genitalia the most important character to distinguish this genus from *Ariophanta* is the presence of a muscular band, given off from the retractor muscle and holding part of the penis doubled into a loop. Apart from this looped arrangement, the male organ is elongate and simple, with the retractor muscle attached to a longer or shorter straight cæcum as in *Ariophanta*. Amatorial organ and other appendages as in *Ariophanta*. Spermatheca very short. Vas deferens leading to junction of kalc-sac and epiphallus. Spermatophore as in *Ariophanta*.

Kidney short. Radula [out of 11 species examined, 9 have the admedian band of teeth a little more than half as wide as in *Ariophanta*, in proportion of 28:42 respectively]. Jaw with or without median projection.

[Before commencing the list of species in the genus *Euplecta*, it becomes necessary to refer to the position of one of Semper's types, viz. *E. layardi*, Pfr., to avoid possible confusion in the future. Dr. W. T. Blanford in his MS. makes *Helix baconi* from Moradabad, *subdecussata* from Bombay, and *layardi* from Ceylon one and the same species—figuring the shell of *layardi* under the name of *baconi*, this name of Benson's having priority. The very little we know of *Helix baconi* does not bear out this conclusion, and I am constrained to keep all three species separate, for reasons given further on, as well as our knowing nothing of the animal of true *H. baconi* from Moradabad nor of *subdecussata* from Bombay. Blanford's MS. is as follows under no. 81, *Euplecta baconi=layardi.*]

An examination of the type of Benson's *Helix baconi* has shown that it is an immature shell of *H. subdecussata*, Pfr., which is the Indian form of the Ceylonese *H. layardi*. *H. convexiuscula* is a small form of the same species. Pfeiffer's original description of *H. layardi* was also taken from an immature shell.

Large specimens from Ceylon measure as much as 18 mm. in major diameter; small shells from Orissa only 12.

E. subdecussata (or rather *E. baconi*), the Indian form but also occurring in Ceylon, is rather more closely wound than the Ceylonese *E. layardi*, but there is variation in this respect. The two, however, may be regarded as races or subspecies.

Specimens from Baticaloa and Hambantote on the east coast of Ceylon are fulvous horny.

The whorls of *E. baconi* were said in the original description to be bordered by a narrow dark rufous band. This cannot now be detected.

The animal of *E. baconi* is said to have "only a small right lobe (? shell-lobe); very small projections above the narrow compressed mucous gland; furrows of the sole of foot indistinct; livid colour, blackish on the mantle, round the pulmonary orifice" (*Stoliczka*, quoted by Nevill, *l. c.*).

[The best recorded series of the three species in question, with accurate localities, is in the Indian Museum, Calcutta, and Geoffrey Nevill keeps them distinct in his Hand-list. Taking his *H. baconi* first, we cannot discard Benson's description of the whorls being ornamented by a rufous band, although, as Blanford says, this cannot be detected in the shell bearing this name in the McAndrew (Benson's) Collection at Cambridge. This may be due to bleaching. Benson's collection, after his death, did not receive the care that it should have. "India" was substituted for Benson's precise localities; many of the types are not now to be found, and so-called types are not in every case to be depended on, and now require to be verified by specimens collected in the typical localities.

I have before me a book from the Indian Museum Library, "Drawings of the Animals of Helicidæ executed under the Superintendence of the late Ferd. Stoliczka." Among these is the water-colour drawing of the shell and animal from life of a specimen taken in the "Botanical Gardens, Calcutta; got it also from Moisraka": marked "*subdecussata*?" in Stolicza's handwriting—"*N. baconi*, Bs.," entered afterwards, in that of G. Nevill.

The shell is shown with a rufous band on the upper whorls, which in the present connection is a most important point, because no band of this sort is to be seen in *Euplecta layardi* and the closely allied species from Ceylon. Stoliczka's description in this book of this animal is as follows:—"*subdecussata*?" We must remember these notes were slight, made for his own use, and not for publication. "Only a small right lobe; horn above gland small; livid coloured, blackish on the mantle round the pulmonary orifice; pedicles dark; the furrows * on the sole indistinct."

In Nevill's Hand-list, p. 35, no. 134, *Nanina* (*Sitala*?) *baconi*, Benson, we have not the above original description, but one drawn up by Nevill, partly from the description, partly from the drawing; and Blanford (see above) quotes Nevill's description, which is incorrect and unmeaning in this sentence, "very small projections above the narrow compressed mucous gland." Nevill was looking at the figure, which is a very detailed drawing by the native artist, size of life, and he did not make out that the said projections were below the hooked gland (which is well seen with a lens), and represent the termination of the foot behind on the level of the sole.

Nevill records this species (*baconi*) in the collection from Benares (2), Moisraka and Calcutta (20), Chandbali (2), Kulu Valley? (1). From Benares, Moradabad is distant some 350 miles further to the north-west, from Calcutta 650 miles. I may remark here that these shells had never been compared with the type, the

* [There are no furrows on the sole. Sole here, I suggest, refers to foot and the furrows to the peripodial grooves.]

single specimen of which Nevill had never seen, so that there is very considerable doubt whether his determination is correct. Turning next to No. 133, p. 34, *Nanina* (*Sitala*?) *subdecussata*, Pfeiffer, it is clear that Nevill considered this species distinct from No. 134, and he gives as the locality Madras (10) and Pooree (*Raban*, 2); var. (? distinct species) Trichinopoly (1), Stoliczka: these had apparently not been compared and verified with the species from the typical locality Bombay, on the opposite coast of India: so far, this identification is unsatisfactory. No. 128, *Nanina* (*Sitala*?) *layardi*, Pfr., p. 34: Nevill's record is all from Ceylon, includes shells given by Layard himself, and Nevill clearly distinguished them from No. 133 and No. 134.]

A. Shell turbinate or subturbinate, thin, horny, finely decussated above.

79. **Euplecta layardi**, *Pfr.* (Helix) *P. Z. S.* 1851, p. 253; *id. Mon. Hel.* iii, 1853, p. 55; *id. t. c.* vii, 1876, p. 101; *Semper* (Euplecta), *Reise Phil., Wiss. Res.* iii, 1870, p. 14, pl. 3, figs. 3, 4 (anatomy); *H. & T.* (Helix) *C. I.* 1876, pl. 56, figs. 8, 9; *Nev.* (Nanina-Sitala) *Hand-l.* i, 1878, p. 34.

Helix convexiuscula, *Pfr. P. Z. S.* 1855, p. 91; *id. Mon. Hel.* iv, 1859, p. 35; *H. & T. C. I.* 1876, pl. 128, figs. 5, 6.

Shell perforate, depressedly turbinate, thin, whitish horny,

Fig. 31.—*Euplecta layardi.*

finely decussated above with oblique striæ and spiral compressed lines, the latter occasionally faint or wanting, smoother and radiately striated below; spire conoidal, apex subacute, suture slightly impressed; whorls 6, moderately convex above, the last keeled, more or less bluntly, convex beneath; aperture slightly oblique, roundly lunate, sometimes angulate; peristome thin, columellar margin vertical above, briefly reflexed, nearly covering the perforation.

Major diam. 16, min. 13½, height 11 mm.

Hab. Ceylon, Kandy (*Nevill*), Baticaloa, Hambantote (*Preston*).

80. **Euplecta subdecussata**, *Pfr. P. Z. S.* 1857, p. 107; *id. Mon. Hel.* iv, 1859, p. 28; *H. & T. C. I.* 1876, pl. 56, fig. 4; *Nev.* (Nanina-Sitala?) *Hand-l.* i, 1878, p. 34.

[Shell perforate, turbinate, thin, irregular plicate striation, above the spiral lines obsoletely decussate, transparent, glassy green; spire conical, apex obtuse; whorls 6, slightly convex, the last not descending, periphery subcarinate, base convex, polished; aperture oblique, widely lunate; peristome simple, straight, margins remote, columellar scarcely reflected.

Major diam. 14, min. 12, axis 9 mm.

Hab. Near Bombay.

I have specimens from Poona, from one of which I extracted the radula, but could not count the lateral teeth, which were broken up. The admedian formula was + 2 . 12 . 1 . 12 . 2 + (or +14 . 1 . 14 +). Jaw moderately arched, with a central projection.]

Nevill records this species from Madras (*W. T. B.*) and Pooree (*Raban*).

81. **Euplecta ? baconi**, *Bs.* (Helix) *A. M. N. H.* (2) vi, 1850, p. 251; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 55; *id. t. c.* vii, 1876, p. 105; *H. & T.* (Helix) *C. I.* pl. 56, fig. 7; *Nev.* (Nanina-Sitala ?) *Hand-l.* i, 1878, p. 35.

[Shell narrowly perforate, depressedly turbinate, very thin, transparent, pale horny, above slightly shiny, beautifully decussate with wavy striation, below polished, radiately striate; spire slightly elevated, slowly increasing, apex obtuse, dark; suture impressed; whorls 5, subconvex. Upper surface with a narrow dark red band, at last obsolete on the margin, the last subcarinate, beneath convex; aperture subvertical, subquadrately lunate; peristome acute, columellar margin vertical, rounded on the basal margin, above very shortly reflected. (Taken from Benson's description.)

Major. diam. 14, min. 13, axis 7 mm.

Hab. Rare in the Rohilla Country near the town of Moradabad (on bank of Gungun River), Northern India (*Dr. J. F. Bacon*).

Mr. F. A. Potts, the Assistant Superintendent, University Museum of Zoology, Cambridge, replying to my letter regarding this species, says:—"We have the type of *Helix baconi*, Bs.; it shows a narrow fuscous band between the whorls."

Nevill records this species from Benares and Calcutta; there is considerable doubt as to the accuracy of the identification, and until the anatomy of the animal is examined the generic position is equally doubtful.]

82. **Euplecta acalles**, *Pfr.* (Helix) *P. Z. S.* 1856, p. 327; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 34; *H. & T.* (Helix) *C. I.* 1876, pl. 128, figs. 1, 4.

Very similar to *E. layardi*, but lower in spire, being more depressedly turbinate and more sharply carinate. A thin whitish horny shell, finely decussated above.

Major diam. 13, min. 11, axis 7½ mm.

Hab. Nilgiris (*Conway Shiplay*). This shell does not appear to have been obtained by later observers.

83. **Euplecta pulchella**, *Blf. P. Z. S.* 1904, ii, p. 447, pl. 25, fig. 18.

Shell subobtectly perforate, conoidly depressed, sublenticular, rather solid, amber-coloured, decussately striated above and below, ornamented above by minute, oblique, granular, flexuous ridges,

crossed by impressed spiral lines, smoother and polished beneath; spire conoidal, apex obtuse, suture impressed; whorls 5, convex, the last descending a little towards the mouth, bluntly angulate at the periphery, convex beneath, compressed around the perforation; aperture large, diagonal, roundly lunate; peristome thin, arcuate above near last whorl, columellar margin oblique, expanded, more broadly above, and thickened, partly covering the perforation.

Major diam. 11½, min. 10, height 6½ mm.

Hab. Anaimalai Hills (*Beddome*).

This is a peculiar form to be recognized by its large diagonal aperture and granular sculpture, which is easily seen under a good lens.

Euplecta? mucosa, *W. & H. Blf.*

[Transferred to end of this genus, after other doubtful species placed in it.]

B. Depressedly turbinate, or turbinate or lenticular, generally sharply keeled, with granular costulation or striation on upper surface.

84. **Euplecta semidecussata**, *Pfr.* (Helix) *P. Z. S.* 1851, p. 252; *id.* (Helix) *Mon. Hel.* iii, 1853, p. 53; *id. t. c.* vii, 1876, p. 105; *H. & T.* (Helix) *C. I.* 1876, pl. 58, figs. 1, 2; *Nev.* (Nanina) *Hand-l.* i, 1878, p. 29; *Godwin-Austen, Mol. Ind.* ii, 1898, p. 101, pl. 97, figs. 2–2 *d* (anatomy), pl. 98, fig. 5 (sculpture of shell).
Euplecta transpetata, subsp., *Blf. Proc. Mal. Soc.* iv, 1901, p. 249, pl. 25, fig. 9.

Shell subobtectly perforate, depressedly turbinate, white, with a fulvous to dull chestnut epidermis, striated, the striation broken and decussated by impressed lines, which are less distinct below; spire conoid, apex acute, suture impressed; whorls 7, slowly increasing, convex above, the last not descending, angulate (varying from subangulate, or even rounded, to carinate) at the periphery, more convex below than above; aperture oblique, angulately lunate; peristome straight, slightly obtuse in adults, columellar margin briefly reflected, partly covering the perforation.

Major diam. 33, min. 30, axis 19 mm.

[*Animal.* Sole of foot not divided, in spirit folded on the central line. There is a minute rudiment of a right shell-lobe, the left dorsal is in two parts, the anterior very close to the posterior. The male organ has a large loop formed by a strong connecting muscle a short distance above the generative aperture. The spermatheca is short and globose. Jaw has a very slight central projection (fig. 30 B, p. 52). Radula (fig. 30 B) formula:

82 . 2 . 19 . 1 . 19 . 2 . 82
or 103 . 1 . 103]

Hab. South-western Ceylon; Rambodde (*Nevill*); Ambagamuwa

(*Collett*), amongst fallen leaves in forest and scrub; Travancore hills (*Beddome*).

This shell varies in colour, form, and size. The decorticated shell is almost white; the epidermis varies in colour from straw-colour to chestnut. The typical form is carinate, but there is a variety, usually thicker, the var. *solida* of Hanley (Conch. Indica, pl. 58, fig. 2, p. 27), in which the periphery is subangulate or even rounded, and two specimens in Mr. Sykes's cabinet measure respectively 38, 32, 21 mm., and 32, 29½, 21 in their three dimensions, the smaller specimen being much the higher in the spire.

E. transpetata, the variety from Travancore obtained by Beddome, is thinner, and chestnut in colour; it is also of small size, the largest specimen measuring 30, 27½, and 18½ mm.

*85. **Euplecta rosamonda**, *Bs.* (Helix) *A. M. N. H.* (3) v, 1860, p. 381; *Pfr. Mon. Hel.* v, 1868, p. 77; *H. & T.* (Helix) *C. I.* 1876, pl. 59, figs. 5, 6.

Distinguished from *E. semidecussata* by being turbinate and having a much higher spire. The last whorl is rounded at the periphery and tumid below. The upper whorls are more convex and the sculpture decussate and granulate.

Major diam. 37, min. 33, axis 24 mm., according to Benson, but the figure in Hanley measures: major diam. 36, axis 27; and there is one specimen with these dimensions in the McAndrew Collection at Cambridge.

Hab. Matelle (? Matale N. of Kandy), Ceylon (*Layard*).

This is in all probability a turbinate variety of *E. semidecussata*.

86. **Euplecta subcastor**, *Beddome* (Nanina), *P. Z. S.* 1891, p. 313, pl. 29, figs. 1–3.

Shell perforate, lenticular, sharply keeled, deep fulvous, rugately striated above, smoother below, decussated throughout with subobsolete impressed lines; spire low, conoid, with convex sides, suture scarcely impressed; whorls 6½, gradually increasing, almost flat above, the last compressedly keeled, moderately convex below, not descending; aperture oblique, angularly lunate; peristome white, obtuse, columellar margin oblique, curved, very briefly reflected above.

Major diam. 31, min. 28, axis 13½ mm.

Hab. Myhendra Hill, S. Travancore, about 2500′.

A shell sent by Mr. W. M. Daly from the Kadar district of Mysore is very similar and may be regarded as a variety. It is much smaller, measuring 25 mm. in major diameter.

87. **Euplecta travancorica**, *Bs.* (Helix) *A. M. N. H.* (3) xv, 1865, p. 13; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 130; *H. & T.* (Helix) *C. I.* 1876, pl. 50, fig. 6, pl. 149, fig. 7.

? Helix læta, *Pfr. P. Z. S.* 1854, p. 287; *id. Mon. Hel.* iv, 1859,

p. 38; *Rv. Conch. Ic.* no. 1380; *Bs. A. M. N. H.* (3) xiii, 1864, p. 497.

Euplecta præeminens, *Sykes, Proc. Mal. Soc.* iii, 1898, p. 71, pl. 5, figs. 5, 6; *Godwin-Austen, Mol. Ind.* ii, 1899, p. 100, pl. 86, figs. 1–7 (anatomy).

Euplecta agastyæ, *Bedd.* (subsp.), *Blf. Proc. Mal. Soc.* iv, 1901, p. 250, pl. 25, fig. 10.

Shell perforate, turbinately depressed, sublenticular, thin, horny, fulvous, ornamented above with fine, oblique, costulate striation, bearing elongate granules arranged in close spiral lines, smoother and more polished, but still decussately striated, below, the spiral impressed lines disappearing near the umbilicus; spire low conoid, sometimes with concave sides, apex acute, sometimes prominently

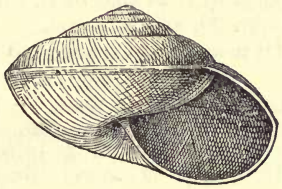


Fig. 32.—*Euplecta travancorica.*

raised and papillar, suture impressed; whorls 6, regularly increasing, convex above, the last sharply keeled, not descending, swollen below; aperture oblique, roundly lunate, angulate at keel of last whorl; peristome thin, basal margin regularly curved, columellar briefly reflexed above.

Major diam. 35, min. 30, axis 20 mm.

Hab. Hills near Kottayam, Travancore (*Kohlhoff, Beddome*); Watawala, S.W. Ceylon (*Collett*), Iléwahetta, Hinidun (*H. Nevill*).

The measurements are from an adult shell in Col. Beddome's Collection. Benson's original type measured 29 mm. in major diameter, but was not adult. This shell, now in the Cambridge Museum, had the keel white with the colour deeper on each side, a coloration found in a few specimens only.

E. præeminens from S.W. Ceylon is a well-marked form with the apex prominent and papillar, and the sides of the spire consequently concave. The sculpture is a little weaker, especially beneath the last whorl. Other Ceylon specimens in my own and my brother's collection connect the two forms. The type of *E. præeminens* measured: major diam. $28\frac{1}{2}$, axis 15 mm.

[In a specimen from Watawala (*O. Collett*) there is a minute right shell-lobe but no left shell-lobe. The right dorsal lobe is moderately large, the left in two distinct parts, the posterior long and narrow (fig. 30 D, p. 52). The jaw has a central projection on a strongly concave edge (fig. 30 D). The teeth of the radula (fig. 30 D) are arranged: 54 . 1 . 21 . 1 . 21 . 1 . 54, or 76 . 1 . 76. The mucous pore is large, extending to the sole of the foot, which is undivided (fig. 30 D).]

Helix læta (Pfr. P. Z. S. 1854, p. 287 ; id. Mon. Hel. iv. p. 38 ; Rv. Conch. Ic. no. 1380), from an unknown locality, was identified by Benson (A. M. N. H. (3) xiii, 1864, p. 497) with shells from the Anaimalai Hills. Judging by the figure in Reeve (the species is not mentioned in the ' Conchologia Indica') *H. læta* must have been very similar to *E. travancorica*, and may have been identical, in which case the name *læta* has priority. The type has disappeared, but a specimen in Cambridge from Benson's Collection thus named is *E. acuducta*.

A variety exists with the keel white as in *E. albizonata*. It is figured by Hanley, C. I. pl. 149, fig. 7.

E. agastyæ is similar to *E. travancorica*, but thinner, less sharply keeled, more swollen below, and more finely sculptured, with the lower surface less polished than that of *E. travancorica*.

Major diam. 34, min. 30, axis 22½ mm.

Hab. Agastyamalai near Cape Comorin, 4000 feet (*Beddome*).

88. **Euplecta indica**, *Pfr.* (Helix) *Symb.* iii, 1846, p. 66; *id. Mon. Hel.* i, 1847, p. 80; *id. t. c.* vii, 1876, p. 132; *Rv. Conch. Ic.* no. 448; *H. & T.* (Helix) *C. I.* 1876, pl. 55, fig. 10; *Blf. J. A. S. B.* 1866, 2, p. 39; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 31.

Helix oblita, *Pfr. P. Z. S.* 1851, p. 263; *id. Mon. Hel.* iii, 1853, p. 54; *id. t. c.* vii, 1876, p. 100.

Helix shiplayi, *Pfr. P. Z. S.* 1856, p. 327; *id. Mon. Hel.* iv, 1859, p. 38; *H. & T. C. I.* 1876, pl. 131, figs. 7, 10; *Godwin-Austen, Mol. Ind.* ii, 1898, p. 102.

Euplecta malabarica, subsp., *Blf. Proc. Mal. Soc.* iv, p. 250, pl. 25, fig. 5; *E. A. Smith, Faun. Geog. Mald. Lac. Is.* p. 114.

Shell perforate, subturbinate, lenticular, rather solid, isabelline to fulvous throughout; ornamented above with slightly arcuate costulation, decussated by impressed spiral lines, which are often obsolete, each rib bearing raised points or granules at subequal distances; spire conoid, with convex sides; whorls 5½–6, slowly

Fig. 33.—*Euplecta indica.*

increasing, convex, the last keeled, smooth beneath and radiately striated with a few concentric impressed lines below the keel, lower surface moderately swollen; aperture oblique, angularly lunate; peristome obtuse, white, columellar margin oblique, curved, briefly reflexed above.

Major diam. 22, min. 19, axis 12 mm.

[The animal of *E. shiplayi* has a very minute right shell-lobe; no left shell-lobe. Left dorsal lobe similar to that of *E. præeminens*. Formula of radula: 50 . 3 . 12 . 1 . 12 . 3 . 50, or 65 . 1 . 65. Lateral teeth bicuspid.]

Hab. Nilgiri, Anaimalai, and Pulni Hills, the Wynaad and Western Mysore as far north as the Kadur district; S. Canara; the lower country of Malabar (Nellumbur, Beypur), Travancore (*Day*); Ceylon (*Beddome*); N. Mahlos Atoll, Maldives (*Gardiner*).

A common species on the Nilgiris from near the base to the top of the plateau, and both on the eastern and western sides; also common in places in Malabar. There is considerable variation in size and sculpture. Typical *E. indica* is costulately striated with distinct spiral impressed lines, and with very small granulation, whilst typical *E. shiplayi* is smaller (20, 17, 12 mm.), higher in the spire, with stronger file-like sculpture. A large Nilgiri specimen measures in the three dimensions 27, 24, and 15 mm.; a small variety from Beypore 15½, 14, and 9. The latter belongs to the form called *E. malabarica*, and appears to inhabit the tract of country near the Malabur coast as far north as North Canara. This is found in the N. Mahlos Atoll, Maldives, doubtless introduced with plants.

89. **Euplecta albizonata**, *Dohrn* (Helix), *P. Z. S.* 1858, p. 133; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 90; *H. & T.* (Helix) *C. I.* 1876, pl. 52, fig. 6.

Similar to the large variety of *E. indica* in general form, but less sharply keeled and dull chestnut in colour, with, round the periphery, a narrow white band, which is conspicuous inside the aperture; area round the umbilicus paler. The suture is deeper and the whorls above more convex.

Major diam. 25, min. 22, height 14 mm.

Hab. Ceylon (*Thwaites*); Travancore (*Beddome*).

A large Travancore specimen measures 29 mm. in major diameter; height 15. This form probably passes into *E. indica*.

90. **Euplecta emiliana**, *Pfr.* (Helix) *P. Z. S.* 1852, p. 83; *id. Mart. & Chemn. Syst. Conch.-Cab.* ed. 2, Helix, no. 1075, pl. 158, figs. 33–35; *id. Mon. Hel.* iii, 1853, p. 55; *Rv. Conch. Ic.* no. 608; *H. & T.* (Helix) *C. I.* 1876, pl. 56, fig. 10.
Helix cingalensis, *Bs. A. M. N. H.* (3) v, 1860, p. 383; *Pfr. Mon. Hel.* v, 1868, p. 93; *H. & T. C. I.* 1876, pl. 54, figs. 1, 2.

Shell perforate, lenticular, fulvous to isabelline, horny, translucent, closely and arcuately costulate above, the ribs bearing granular elevations separated from each other by impressed spiral

Fig. 34.—*Euplecta emiliana.*

lines, smooth and radiately striated beneath; spire conoid, apex varying, but generally acute; whorls 6, rather convex above, slowly and regularly increasing, the last not descending, sharply keeled,

convex beneath; aperture oblique, angularly lunate; peristome thin, upper margin arcuate, basal margin, seen from beneath, straight or slightly convex, columellar oblique, briefly reflexed above.

Major diam. 16½, min. 15, axis 9 mm.

Hab. Hills of South-western Ceylon, Matelle (*Layard*), Balapiti (*Nevill*), Ambagamua (*Collett*), Newara Ellia (*F. Layard*).

This is the Ceylon representative of *E. indica*, and, like that shell, varies in sculpture, in the sharpness of the keel, and in the height of the spire. As a rule, the present form is smaller and more closely wound than *E. indica*, and it appears to be constantly distinguished by the peristome, the basal margin of which, viewed from beneath, is always concave in *E. indica*, straight or even faintly convex in adults of *E. emiliana*.

91. **Euplecta lævis**, *Blf. Proc. Mal. Soc.* iv, 1901, p. 257, pl. 25, fig. 8.

Shell obtectly perforate, depressedly turbinate, carinate, almost lenticular, whitish horny, translucent, the basal surface marked with fine, close, concentric, opaque white lines, smooth, minutely decussately striated above, radially striated beneath; spire conoid, suture impressed; whorls 6, convex above, the last sharply keeled at the periphery, convex below; aperture slightly oblique, angularly lunate; peristome thin, columellar margin vertical above, briefly triangularly reflexed, partly covering the perforation.

Major diam. 17, min. 15, axis 9½ mm.

Hab. Ceylon (*Yerbury*).

This shell is related to *E. emiliana*, but is more sharply keeled, and differs in its smooth upper surface and in the milky concentric lines on the base.

92. **Euplecta binoyaensis**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 103, pl. 97, figs. 1–1 *d* (shell and anatomy); *Blf. Proc. Mal. Soc.* iv, 1901, p. 250, pl. 25, fig. 7.

Shell perforate, depressedly turbinate, carinate, fulvous horny, with the keel whitish, rather thin, finely, closely, and arcuately costulate above, the ribs bearing fine granules close together and arranged in spiral lines; spire conoid; whorls 5, convex above, slowly and regularly increasing, the last with a raised prominent keel, considerably swollen below the keel, smooth and radiately striated; aperture oblique, roundly lunate, angulate at the periphery; peristome simple, columellar margin oblique, slightly reflexed at the perforation.

[Generative organs as in the genus. The muscular cæcum (*crp.*) is short. In this specimen a spermatophore in process of formation was seen and is noticeable as quite unlike those of the Macrochlaminæ (fig. 30 C, p. 52). It consists of a large elongate conoid mass set on one side with minute spines at the base, these becoming in succession larger above; where the vas deferens

unites with the penis is the thin capsule also spined down the side, the spines being bifid and arranged in sets of two together.

The radula was similar to other species of the genus, arranged:

+40 . 2 . 12 . 1 . 12 . 2 . 40+
+54 . 1 . 54+

Some of the outermost laterals not seen.]

Major diam. 12, min. 10, axis 6·5 mm.

Hab. Watawala, Ceylon (*Collett*).

Distinguished from *E. emiliana* by fewer whorls, much more prominent keel, much rounder and higher mouth, and by the body-whorl being considerably more tumid beneath the keel.

93. **Euplecta verrucula**, *Pfr.* (Helix) *P. Z. S.* 1854, p. 50; *id. Mon. Hel.* iv. 1859, p. 40; *id. t. c.* vii, 1876, p. 105; *H. & T.* (Helix) *C. I.* 1876, pl. 150, fig. 9; *Blf. Proc. Mal. Soc.* iv, 1901, p. 251, pl. 25, fig. 6.

Nigritella nerva, *Jousseaume, Mém. Soc. Zool. France*, vii, 1894, p. 275 (*Sykes, Proc. Mal. Soc.* iii, 1898, p. 65).

Shell perforate, turbinate, sharply keeled, thin, horny, translucent, finely costulate above, each rib bearing about 10 elongate granules, separated by equidistant impressed spiral lines, lower surface polished, radiately striated; spire conoidal, apex acute; whorls 6, slightly convex above, the last with a sharp compressed keel, convex beneath; aperture slightly oblique, angularly lunate; peristome thin, basal and columellar margins curved, the latter reflected throughout, more broadly above.

Major diam. 14, min. 13, axis 8 mm.

Hab. S.W. Ceylon (*Thwaites*), Uda Pussellawa, Watawala (*Collett*); Fort McDonald (*H. Nevill*).

This has a much higher spire than *E. emiliana*, and there are fewer spiral impressed lines, about 10, on the last whorl. Pfeiffer's description was taken from half-grown shells, and these have been figured by Reeve and Hanley. The above description is from adults in Mr. E. R. Sykes's collection. Specimens from Fort McDonald have a white keel.

94. **Euplecta fluctuosa**, *Blf. Proc. Mal. Soc.* iv, 1901, p. 251, fig. 1.

Shell subobtectly perforate, turbinate, carinate, pale horny, closely and finely ornamented throughout with flexuous transverse rows of granules arranged in spiral lines, the lower surface smooth, decussately striated; spire conoid, apex obtuse, suture impressed; whorls 5, convex, the last compressedly keeled, convex below; aperture diagonal, approaching a rhomb in form, margins converging slightly; peristome thin and in one plane, columellar margin triangularly reflected.

Major diam. 11½, min. 10½, axis 7 mm.

Hab. Gaisoppa Falls, North Canara.

This shell is distinguished by its peculiar flexuous and granular sculpture, few whorls, and diagonal aperture.

95. **Euplecta prestoni**, *Godwin-Austen, Proc. Mal. Soc.* ii, 1897, p. 177, pl. 14, figs. 1–1 *e* (part of anatomy and radula).

Shell perforate, subturbinate, keeled, thin, fulvous horny, closely ornamented with fine oblique filiform costulation above, the ribs bearing small granules, from which hair-like spines are developed at regular intervals; spire conoid, apex obtuse, suture impressed. Whorls 5, closely wound, convex above, the last compressed below the keel at the periphery, convex, smooth, and polished beneath; aperture oblique, angularly lunate, columellar margin vertical above, reflected throughout, partly covering the perforation.

[The dental formula is 28.10.1.10.28, or 38.1.38. The centre tooth is elongate, with cusps low down on either side; the admedian teeth with a large cusp on the outer side; the laterals bicuspid, the innermost the longest. The jaw has a central projection.]

Major diam. 5·25, min. 4·9, axis 4 mm.

Hab. Ceylon, Uda Pussellawa (*Preston*).

The shell described is immature, and it is possible the full-grown shell may be considerably larger. The spines can only be seen under a microscope.

96. **Euplecta scobinoides**, *Sykes, Proc. Mal. Soc.* ii, 1897, p. 234, pl. 16, figs. 1, 2.

Shell perforate, lenticular, dark brownish horny, translucent, marked above with fine close arcuate filiform striæ, which are granularly decussated by spiral lines lying close together towards the outside of each whorl, further apart inside, [below smooth, with microscopic wavy, longitudinal striæ]; spire low, apex blunt, sutures slightly impressed; whorls 5, narrow, slowly increasing, plano-convex above, the last sharply keeled, compressed beneath the keel, convex, smooth, and polished on the lower surface; aperture slightly oblique, narrow, angularly lunate; peristome thin, basal margin arcuate, columellar oblique, slightly reflected.

Major diam. $8\frac{3}{4}$, min. 8, axis $4\frac{1}{4}$ mm.

Hab. Ceylon, Watawala (*Collett*).

[97. **Euplecta gardeneri**, *Pfr.* (See above, p. 40.)

The animal with the visceral sac black, probably very dark grey in life. Right dorsal lobe ample, the left in two distinct widely separated parts, the posterior long and narrow. A pointed lobe over the mucous gland. Sole of foot with no division; the peripodial margin narrow, the parallel grooves above wide apart. In the genitalia the penis is looped up for a considerable length by a strong muscle encircling the main penis-sheath. The cæcum of the retractor muscle is long, and there is a shortish blunt kalc-sac. The spermatheca very small and sessile. Amatorial organ long and large. Jaw curved, with a very slight central projection.

Radula with the lateral teeth evenly bicuspid; formula:

$$\frac{48 \,.\, 1 \,.\, 14 \,.\, 1 \,.\, 14 \,.\, 1 \,.\, 48}{63 \,.\, 1 \,.\, 63}$$

Although the shell is so very different to typical species of the genus, both this radula with the generative organs are conformable, and not with the same characters of *Ariophanta*. I therefore have to transfer it from where Blanford placed it to its present position in *Euplecta*.]

C. Globosely conoid or depressed, with rounded periphery.

98. **Euplecta subopaca**, *Pfr.* (Helix) *P. Z. S.* 1853, p. 125; *id. Mon. Hel.* iv, 1859, p. 55; *id. t. c.* vii, 1876, p. 118.
Helix corylus, *Rv. Conch. Ic.* Helix, no. 1439, pl. 204; *H. & T. C. I.* 1876, pl. 150, fig. 3.

Shell subobtectly perforate, convexly depressed, solid, rufous horny (varying from yellowish white to pale chestnut), having a silky lustre and fine arcuate costulation above, smooth, polished, and radiately striated beneath; spire low, convex to conoid, suture scarcely impressed; whorls 6, closely wound, flatly convex above,

Fig. 35.—*Euplecta subopaca.*

the last broader, rounded at the periphery, convex below; aperture oblique, lunate; peristome thin, basal margin straight when looked at from beneath, columellar oblique, regularly curved, slightly expanded, more broadly at the perforation.

Major diam. 15, min. 13½, axis 9 mm.

Hab. Higher Hills of South-western Ceylon; Nuwara Eliya (*G. Nevill*); Pedro Talle Galle, 6000′ (*H. F. B.*), Gampala (*H. Nevill*).

99. **Euplecta partita**, *Pfr.* (Helix) *P. Z. S.* 1853, p. 125; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 55; *id. t. c.* vii, 1876, pp. 118, 532; *H. & T.* (Helix) *C. I.* 1876, pl. 85, figs. 5, 6; *Godwin-Austen, Mol. Ind.* ii, 1899, p. 98, pl. 87, figs. 1–1 *e* (anatomy).
Helix marcida, *Bs.* (*nec Shuttleworth*) *A. M. N. H.* (2) xii, 1853, p. 92.
Helix subconoidea, *Pfr. P. Z. S.* 1854, p. 51; *id. Mon. Hel.* iv, 1859, p. 56; *id. t. c.* vii, 1876, pp. 118, 532; *H. & T. C. I.* 1876, p. 36, pl. 85, figs. 7, 10.

Shell subobtectly perforate, convexly depressed, rather thin, isabelline to yellowish horny, polished, strongly but rather irregularly transversely rugosely striated above, smooth with radiating

striation beneath; spire low, apex obtuse; whorls 6, convex, slowly increasing, the last rounded at the periphery, rather flatly convex beneath; aperture slightly oblique, lunate; peristome thin, basal margin a little arcuate, columellar slightly expanded, more broadly near the perforation, which is partly covered.

Major diam. 14½, min. 13, axis 7 mm.

Hab. South-western Ceylon; Rhambodde, Matelle East (*Nevill, Layard*); Bolegalle, near Kandy (*H. F. B.*); Ratnapura, Gampola, Nuwara Eliya (*H. Nevill*). From Ambagamua (*O. Collett*).

[The animal (fig. 30 A, p. 52) has the left dorsal lobe divided into a large anterior and a small elongate narrow posterior portion. The lower main sheath of the male organ is very short from the generative aperture upwards; it then diminishes in section and is folded into a large loop confined by a strong broad muscle. Near the return portion of the free loop is a short stout portion, the diverticulum or cæcum, to which the retractor muscle is attached; near the same place is the short kalc-sac which the vas deferens joins. A very remarkable set of finger-like processes occur here (fig. 30 A), marking the place of formation of the spermatophore of peculiar form (fig. 30 C). The radula formula is

$$\begin{matrix} 72 \,.\, 1 \,.\, 13 \,.\, 1 \,.\, 13 \,.\, 1 \,.\, 72 \\ 86 \,.\, 1 \,.\, 86 \end{matrix}$$

The laterals are long, curved, and bicuspid, the outer cusp considerably below the points of the inner.]

There has been some confusion between this and *E. subopaca*, and it is difficult to determine the types, though the original descriptions are perfectly clear. *E. partita* is a thinner, less globose shell than *E. subopaca*, with less strong and less regular sculpture, and of a different colour. *H. subconoidea* was founded on immature specimens of *E. partita*.

A variety with the spire almost or quite flat, and the last whorl subangulate above the periphery, occurs amongst specimens from Ratnapura and Nuwara Eliya in Mr. H. Nevill's collection.

100. **Euplecta trimeni**, *Jousseaume* (Euplectella), *Mém. Soc. Zool. France*, vii, 1894, p. 276, pl. 4, fig. 5.

Shell narrowly perforate, conoidly depressed, thin, fragile, subpellucid, obliquely costulate above, radiately striated beneath, pale olivaceous fulvous; spire low, conoid, suture impressed; whorls 5½, slightly convex, the last depressedly rounded, scarcely descending; aperture oblique, lunate; peristome simple, straight, thin, sharp, columellar margin slightly thickened, reflected and appressed at the perforation, the margins joined by a thin callus.

Major diam. 10, min. 9, axis 7 mm.

Hab. Nuwara Eliya, Ceylon.

Judging from the above description, translated from the original, the single specimen to which the name was given may have been a small thin shell of *E. subopaca*, perhaps immature.

D. Conoidly depressed and carinate.

101. **Euplecta acuducta**, *Bs.* (Helix) *A. M. N. H.* (2) v, 1850, p. 214; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 78; *id. t. c.* iv, 1859, p. 67; ? *H. & T.* (Helix) *C. I.* 1876, pl. 50, fig. 5.
Nanina koondaensis, *Blf. J. A. S. B.* 1870, p. 16, pl. 3, fig. 12; *H. & T.* (Helix) *C. I.* 1876, pl. 56, figs. 5, 6; *Pfr.* Helix (Nanina) *Mon. Hel.* vii, 1876, p. 225; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 29.
Nanina subkoondaensis, *Godwin-Austen* (*Nevill MS.*), *Proc. Mal. Soc.* ii, 1897, p. 175 (no description).

Shell perforate, sublenticular to depressed, carinate, fulvous horny, finely striated above and decussated by rather close spiral impressed lines, similarly marked, but smoother, below; spire very low, conoidal, suture very slightly impressed; whorls $5\frac{1}{2}$, almost

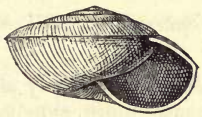


Fig. 36.—*Euplecta acuducta.*

flat above, regularly increasing, the last sharply keeled, compressed beneath the keel, swollen below; aperture oblique, angularly lunate; peristome slightly obtuse, white inside, columellar margin curved, slightly reflected above.

Major diam. 25, min. 21, axis 11 mm.

Hab. Nilgiris (*Jerdon*); Sispára Ghat, Kundah Hills (*W. T. B.*); Tinnevelly; Trevandrum (*Theobald*); Kadur district, Mysore (*Daly*); Ceylon (*G. Nevill, H. F. B.*).

The type of *E. acuducta*, now in Cambridge, is immature; it only differs from *E. koondaensis* in having rather flatter whorls and a sharper keel (both characters due partly to immaturity) and in having the last whorl slightly broader.

The shell from the Kadur district of Mysore is sharply keeled and subcostulately striated.

This species varies in height of spire, sharpness of keel, and sculpture, and some varieties approach *E. indica*, others *E. travancorica*. *E. acuducta* can be easily distinguished, as a rule, by the height of the spire being much less than the depth of the last whorl below the keel.

The animal figured under the present name J. A. S. B. 1882, 2, p. 69, pl. 5. fig. 2, is probably, as is pointed out by Godwin-Austen (*l. c.*), wrongly identified.

102. **Euplecta isabellina**, *Pfr.* (Helix) *P. Z. S.* 1854, pl. 52; *id. Mon. Hel.* iv, 1859, p. 66; *H. & T.* (Helix) *C. I.* 1876, pl. 27, fig. 7. Helix isabella, *H. & T. C. I.* 1876, p. viii; *Nev.* (Nanina) *Hand-l.* i, 1878, p. 29.

Shell perforate, depressed, sublenticular, thin, horny, translucent, straw-coloured to isabelline, striated, the striæ interrupted by impressed lines leaving elongate granules, which form subdistant spiral bands; spire convex, its height forming less than half the axis, apex distinct, suture linear, not impressed. Whorls 5–5½, increasing regularly, flattened above, the last broader than in most allied forms, sharply keeled, not descending, swollen beneath; aperture oblique, angularly lunate, subrhomboidal; peristome thin, basal margin regularly curved, columellar margin almost vertical above, briefly and broadly reflexed.

Major diam. 33, min. 27, axis 15 mm.

Hab. Hills of South-western Ceylon.

103. **Euplecta colletti**, *Sykes, Proc. Mal. Soc.* ii, 1897, p. 234, pl. 16, figs. 5, 6.

Smaller than *E. isabellina*, but closely allied to it. The whorls, 4½ to 5 in number, increase more slowly, and the last whorl is proportionally narrower; the spiral sculpture so conspicuous on *E. isabellina* is almost obsolete or replaced by fine close spiral lines of granules, and the protoconch is smooth. Colour tawny.

Major diam. 21, min. 17½, axis 8½ mm.

Hab. Watawala, Ceylon (*Collett*).

This may be immature, and may be a variety of *E. isabellina*, but it is sufficiently distinct to require recognition.

E. Trochiform.

a. *Sculpture granular.*

104. **Euplecta cacuminifera**, *Bs.* (Helix) *A. M. N. H.* (2) v, 1850, p. 214; *Pfr. Mon. Hel.* iii, 1853, p. 36; iv, 1859; vii, 1876, p. 103; *H. & T. C. I.* 1876, pl. 54, fig. 2.

Shell obtectly perforate, trochiform, thin, horny, with fine granular sculpture above, arranged on the oblique striæ of growth in spiral longitudinal series, varying slightly and somewhat irregularly in size, some series or parts of series of granules being larger than others; spire conoidal with concave sides, apex attenuate; whorls 8, slowly increasing, flat above, the last acutely keeled, compressed below the keel, convex beneath, smooth, polished and radiately striated; aperture scarcely oblique, sharply angulate at the periphery; peristome thin, columellar margin oblique, triangularly reflected above, partly covering the perforation.

Major diam. 18, min. 16, axis 13 mm.

Hab. Nilgiri Hills, S. India (*Jerdon*); Sispara (*W. T. B.*).

This shell is easily recognized by its sculpture.

105. **Euplecta granulifera**, *Blf. Proc. Mal. Soc.* iv, p. 252, fig. 5.

Shell minutely and subobtectly perforate, subturbinately trochiform, thin, horny, ornamented above with numerous minute tubercles, close together, somewhat irregular in size, and arranged in both spiral and transverse series, smooth and finely striated radiately beneath; spire rather high, conical, apex obtuse, the apical whorls smooth, suture impressed; whorls 7, slowly increasing, convex, the last filiformly keeled at the periphery, moderately convex below; aperture nearly vertical, roundly lunate; peristome thin, the margins converging above, columellar nearly vertical, reflected throughout, more broadly above.

Major diam. $6\frac{1}{4}$, min. $5\frac{3}{4}$, axis $5\frac{3}{4}$ mm.

Hab. N. Canara (*Beddome*).

This small species is distinguished at once by its conical spire and peculiarly granular sculpture; the latter, in this and in *E. cacuminifera*, consisting, as seen under the microscope, of minute hemispherical tubercles arranged in series, but not based on ribs as in *E. indica*, &c.

b. *Sculpture finely decussated.*

106. **Euplecta hyphasma**, *Pfr.* (Helix) *P. Z. S.* 1853, p. 124; *id. Mon. Hel.* iv, p. 40; vii, p. 105; *H. & T. C. I.* 1876, pl. 54, fig. 3; [*Godwin-Austen, Mol. Ind.* ii. 1907, p. 186, pl. 114, figs. 1, 1 *a* (genitalia)].

Shell minutely and subobtectly perforate, trochiform, thin, whitish to brownish horny, minutely but regularly obliquely costulated, the ribs bearing very fine granulation, often difficult of detection; spire conical with straight sides, apex acute, suture

Fig. 37.—*Euplecta hyphasma.*

impressed; whorls $6\frac{1}{2}$ to 7, convex above, the last sharply and compressedly keeled at the periphery, moderately convex, smooth, and polished beneath; aperture oblique, rhomboidally lunate; peristome thin, acute, columellar margin subvertical above, regularly curved below, reflected triangularly at the perforation and partly covering it.

[In a spirit-specimen from Ambagamua the animal is pale coloured, the dorsal lobes black, with a patch of same colour on the sides of the neck and near the extremity of the foot; peripodial margin broad; the mantle-zone has no shell-lobes. Jaw has a slight central projection.

Radula with 81 rows of teeth, arranged :

$$\begin{matrix} 48 \,.\, 1 \,.\, 10 \,.\, 1 \,.\, 10 \,.\, 1 \,.\, 48 \\ 59 \,.\, 1 \,.\, 59 \end{matrix}$$

The centre tricuspid, admedian with cusp on outer side ; laterals bicuspid, with points even.

The male organ is a modified form of that of *E. binoyaensis* ; the loop is not present, the muscular cæcum is longer, the amatorial organ is present, and the spermatophore is of the same type.]

Major diam. 13, min. 12, axis 10½ mm.

Hab. South-western Ceylon; Kandy, 2000′ (*G. Nevill, H. F. B.*); Saffragam (*H. Nevill*) ; Ambagamua (*O. Collett*).

107. **Euplecta turritella**, *H. Ad.* Nanina (Rotula) *P. Z. S.* 1869, p. 275 ; *H. & T.* (Helix) *C. I.* 1876, p. 36, pl. 86, fig. 4 ; *Jouss. Mém. Soc. Zool. Fr.* vii, 1894, p. 275.

Nanina (Rotula) conulus, *H. Ad. P. Z. S.* 1867, p. 307, pl. 19, fig. 16; *Pfr. Mon. Hel.* vii, 1876, p. 69; *nec* Helix conulus, *Martens*, 1864.

Very near *E. hyphasma*, but in typical shells the spire is higher, the sides meeting at a more acute angle, the sculpture is finer and the coloration different. The shell is whitish or brownish horny, except on the lower part of each whorl, where it is reddish, and on the last whorl there is a chestnut band above and below the keel, which is itself white. According to Jousseaume, specimens occur with the keel also reddish, and some are chestnut-brown throughout.

Major diam. 11, min. 10, axis 9 mm. The height of the axis differs from Adams's measurements, but is taken from the shell believed to be the type now in the British Museum.

Hab. Nuwara Eliya, Ceylon (*Layard*) ; Monaragalla to Rambodda (*H. Nevill*).

This form passes into *E. hyphasma*.

c. *Smooth.*

108. **Euplecta ? mucronifera**, *Blf. Proc. Mal. Soc.* iv, p. 252, fig. 3.

Shell subobtectly perforate, trochiform, thin, milky white, the whorls irregularly streaked transversely and spirally with dusky horny, neighbourhood of mouth chestnut, covered with a thin epidermis above, greenish yellow and thicker beneath, smooth, scarcely striated ; spire conoid with concave sides, apex prominent, very sharp, suture linear, not impressed ; whorls 7½, flat above, the last sharply and compressedly keeled, moderately convex beneath ; aperture oblique, securiform, dark chestnut inside ; peristome thin, straight, columellar margin descending obliquely, briefly reflexed at the perforation.

Major diam. 18½, min. 16, axis 17½ mm.

Hab. Anaimalai Hills (*Beddome*).

This species has the peculiar acuminate spire of *E. cacuminifera*, but is perfectly smooth.

109. **Euplecta phidias**, *Thorp MS. apud Hanley* (Helix), *H. & T. C. I.* 1876, p. 59, pl. 149, fig. 4 (no description).

Shell imperforate, trochiform, white with a thin yellowish deciduous epidermis, smooth, finely striated obliquely, with traces of obsolete decussating lines; spire conical with perfectly straight sides, sutures not impressed; whorls $6\frac{1}{2}$, perfectly flat above, the last sharply keeled, but little convex beneath; aperture oblique, almost diagonal, subrhomboidal; peristome thin, columellar margin sharply reflected above, covering the perforation.

[A specimen from Kandy, collected by Mr. O. Collett, has a pale ochre-coloured foot with a dark patch on the side of the neck, the overhanging lobe at extremity of foot conspicuous. The peripodial margin very broad, paler than the rest of the body, the grooves above very close together. The left dorsal lobe a narrow strip, not divided into two lobes. In the genitalia the male organ has the distinct loop as in the larger species of the genus, and with a large amatorial organ.

Radula: centre and admedian teeth as usual, the laterals very numerous, long, curved, evenly bicuspid, becoming very minute on the edge. Arranged thus:

60 . 1 . 16 . 1 . 16 . 1 . 60
77 . 1 . 77

Jaw very strongly arched, with no central projection.]

Major diam. $18\frac{1}{2}$, min. 16, axis 14 mm.

Hab. Ceylon, Upper Uva (*F. Layard*).

Distinguished by its flat smooth surface and close perforation. The animal is unknown of the following three species and their generic position is doubtful.

110. **Euplecta? concavospira**, *Pfr.* (Helix) *P. Z. S.* 1853, p. 124; *id Mon. Hel.* iv, p. 32; vii, p. 96; *H. & T. C. I.* 1876, pl. 86, fig. 1.

Shell subperforate, trochiform, thin, whitish horny, with a slight deciduous yellowish epidermis, finely and obliquely striated and subobsoletely decussated; spire conical, apex acute, suture but little impressed; whorls $6\frac{1}{2}$–7, plano-convex above, the last sharply and compressedly keeled, moderately convex around the perforation beneath; aperture slightly oblique, angularly lunate; peristome acute, columellar margin curved, briefly reflected above, nearly covering the perforation.

Major diam. 16, min. $14\frac{1}{2}$, axis 11 mm.

Hab. Ceylon (*Layard*); Kandy (*Simon*); Gongala (*H. Nevill*).

There is very little if any concavity in the sides of the spire. In Hanley's figure a shell is represented with a narrow rufous band above the keel, and in the upper whorls above the suture.

111. **Euplecta? apicata**, *Blf.* [Nanina (Trochomorpha)] *J. A. S. B.* 1870, 2, p. 16, pl. 3, fig. 13; *Pfr. Mon. Hel.* viii, p. 97; *H. & T. C. I.* 1876, pl. 54, fig. 5.

This differs from *E. concavospira* in having the whorls quite flat above and the suture not impressed, and in the almost complete absence of sculpture except slight transverse striation. The apex is slightly exserted and the sides of the spire faintly concave. The colour is horny, sometimes streaked with opaque white.

Major diam. 14, min. 13, axis 10 mm.

Hab. Nilgiri Hills; Coonoor, Neduwattana, and Avalanche (*W. T. B.*); Anaimalai (*Beddome*).

In some specimens the striation is more distinct, and there are traces of spiral sculpture on the upper whorls.

112. **Euplecta? orbiates**, *Blf. Proc. Mal. Soc.* iv, 1901, p. 253, fig. 4.
? Euplecta bifasciata, *Nevill, Godwin-Austen, Proc. Mal. Soc.* ii, 1897, p. 176 (no description).

Shell imperforate, trochiform, thin, diaphanous, obliquely striated above, radiately and arcuately beneath, covered with a deciduous yellowish-fulvous epidermis, thickest below, beneath the epidermis whitish horny, with, in some specimens, two rufous bands, one above, the other below the keel; spire conical, sides slightly concave, apex pointed, suture not impressed; whorls 7–7½, flat above, the last compressedly keeled, slightly convex towards the middle beneath; aperture oblique, subtetragonal, hatchet-shaped; peristome thin, columellar margin vertical above and briefly reflexed, covering the perforation.

Major diam. 14, min. 13, axis 11 mm.

Hab. Myhendra, Travancore (*Beddome*).

Distinguished from *E. apicata* by higher spire and imperforation. Nevill's MS. name is inappropriate, as the bands are not always present.

113. **Euplecta? mucosa**, *W. & H. Blf.* (Helix) *J. A. S. B.* xxx, 1862, p. 353, pl. 1, fig. 9, pl. 2, fig. 3; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 51; *H. & T.* (Helix) *C. I.* 1876, pl. 90, figs. 5, 6; *Nev.* Nanina (Microcystis) *Hand-l.* i, 1878, p. 36.

Shell imperforate, depressedly turbinate, very thin, pale, and more or less yellowish horny, obliquely striated, decussated with microscopic spiral (longitudinal) impressed lines on some of the inner whorls; spire conoidal, apex subacute, suture impressed; whorls 5, moderately convex above, the last considerably broader, slightly compressed at the periphery, tumidly convex beneath, the depth beneath the periphery exceeding the height of the spire; aperture large, oblique, roundly lunate; peristome straight, thin, columellar margin much curved, vertical above and slightly reflected, completely closing the perforation.

Major diam. 8, min. 6½, height 5 mm. A large shell measures 9½ × 8 × 6 mm.

Hab. On the upper portion of the Nilgiris, Pykara, Coonoor Ghat, Seeghoor Ghat, &c., Pulneys (*Fairbank* teste *Nevill*).

This shell is distinguished from *E. layardi* and *E. acalles* by want of perforation and carination and by simpler sculpture. It is also smaller.

[I have found in one of Dr. W. T. Blanford's field note-books a very good figure and a long description of the animal of this species, which I give verbatim as it is so good, descriptions of this sort from life being really of more value than those of the shells.

"*H. mucosa*, W. Blf.: Nilgiris.—No linguiform processes to the mantle. Mantle rather large. Animal dull orange, mantle yellow. Tentacles blackish, with a dark line from the base of each to the mantle. The lobe over the mucous pore very large. Back not carinate. Foot broadly margined by a single line. Animal and mantle coarsely granulate throughout and with irregular dots of a darker colour on the spaces between the wrinkles and especially on the edges of the foot. Animal very active."

This description is sufficient to enable anyone to recognize the species and preserve the animal for dissection.

Blanford placed it next to *E. pulchella*; but as there is considerable doubt whether it belongs to the genus *Euplecta*, I transfer it to the end among other doubtful species.]

[Confining comparison to the formula of the radula in the genus *Euplecta* and the sinistral and dextral forms of *Ariophanta*, marked differentiation is displayed in the far fewer teeth in the radula of the first, whereas in the last two divisions the number is much greater in the proportion of 28 : 45. In the sinistral and dextral species remarkable similarity is found, showing a close relationship with each other and a more distant one with *Euplecta*, differences (specific) being confined in *Ariophanta* more to the form of the teeth themselves. To elucidate this, I have taken the number of the admedian teeth, including the one or two of transition form, of all the species now examined in:

I. The sinistral *Ariophantæ*.
II. The dextral ,,
III. *Euplecta*.

The mean of all these formulæ is interesting, showing how much more numerous the teeth are—that is, how much broader is the central band of teeth set on quadrangular plates—in Nos. I. & II. than in No. III., thus:—

	Number of species examined.	Total admedian teeth on one side only.	Resulting formula.	Total admedian teeth.
I. ..	6	139	23 . 1 . 23	46
II. ..	11 (*vide* names below.)	244	22 . 1 . 22	44
III. ..	12	152	14 . 1 . 14	28

I exclude from No. I. *Ariophanta lævipes*, in which the number of the admedian teeth is so far less numerous than in any other species of the genus, being only 8 on each side of the central tooth, or 16 as compared with 23, and is thus abnormal. From No. III. *Euplecta* I also exclude *E. præeminens* (subspecies of *travancorica*) and *semidecussata*, in which the radula formula is 22 . 1 . 22 and 21 . 1 . 21 respectively, and thus is like that of the dextrorse section of *Ariophanta*, while their generative organs approach those of *Euplecta*. Both these species range to Peninsular India, and thus form a sort of link with the majority of the Ariophantinæ of that side. The generative organs in other species of *Ariophanta* and *Euplecta* show an interesting development of one towards the other.

Species included in the above Genera.

I. *cysis*, *immerita*, *interrupta*, *bajadera*, *intumescens*, *dalyi* (*cysis* var.) : = 6 species.

II. *belangeri*, *bistrialis*, *ceraria*, *solata*, *tranquebarica*, *madarastpatana*, **ligulata*, *ceylanica*, *juliana*=*ganoma*, *basileus*, *chenui* : = 11 species.

III. **layardi*, *phidias*, *shiplayi* = *indica* ?, *partita*, *prestoni*, **subopaca*, *mysorensis*, *binoyaensis*, *hyphasma*, *gardeneri*, *subdecussata*, *colletti* : = 12 species.]

Genus **RATNADVIPIA.**

Ratnadvipia, *Godwin-Austen, Proc. Mal. Soc.* iii, 1899 p. 253 ; *id. Mol. Ind.* ii, 1899, p. 93 ; *Collinge, Jour. Mal.* 1901, viii, p. 64.

Type, *R. irradians*, Pfr.

Range. Ceylon.

Shell *Vitrina*-like, with few whorls, thin, not polished above, the outer whorl large.

Animal large, much larger than the shell. Mantle-edge large, surrounding the shell and partly covering it : both the right and left shell-lobes produced posteriorly into tongue-like expansions ; dorsal lobes greatly developed, the left dorsal lobe in two parts. The dorsum of the body just behind the shell is flat, but it is sharply keeled behind. Caudal extremity truncated ; mucous pore large. Peripheral groove double. Sole with a median groove (not always conspicuous), but not divided into median and lateral tracts.

Radula broad, with numerous teeth in each row ; the formula is 204 . 23 . 1 . 23 . 204 (227 . 1 . 227). The median band of large teeth is very broad, the teeth composing it are simple without lateral cusps ; the numerous lalerals are bicuspid, except the outer marginals. Jaw with a concave edge without median projection.

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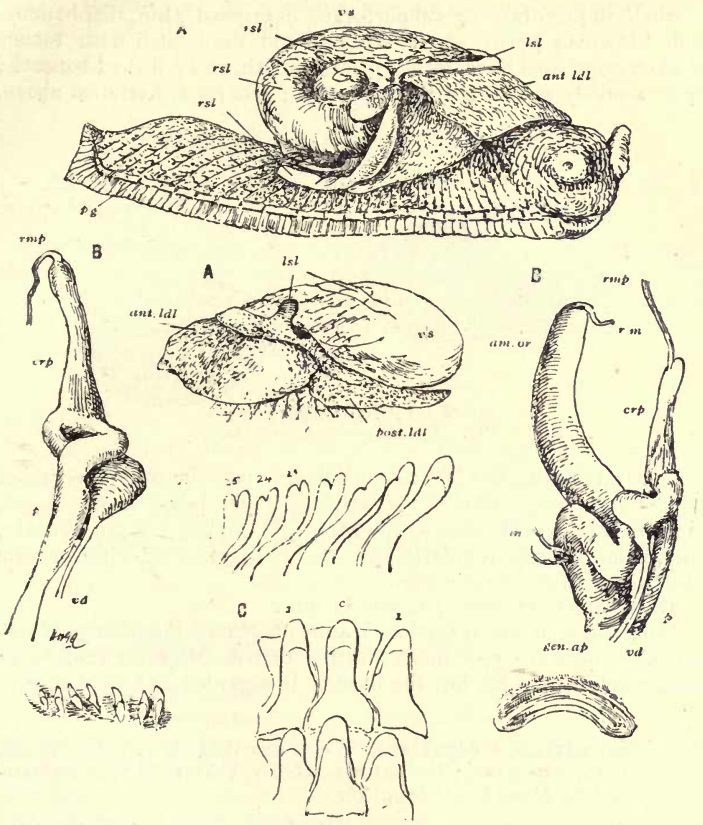
* According to Semper.

An amatorial organ (dart-sac) present, large and cylindrical; no calcareous dart found, but a short blunt muscular papilla. Spermatheca sessile. The vas deferens passes into a kalc-sac, which is joined to the penis-sheath, some distance from the



[Fig. 38.—*Ratnadvipia irradians.*

A. Animal from right side, showing the shell- and dorsal lobes; also part of, from the left side. The shell-lobes are curled up in the spirit-specimen; the dotted line on visceral sac indicates their extension in life. ×1·9.
B. Part of genitalia showing the typical male organ of *Ariophanta*. ×3·4.
C. Jaw and teeth of the radula. ×268.]

retractor muscle, by an epiphallus; cæcum of penis straight, as in *Ariophanta*.

This genus differs from *Indrella* chiefly in the possession of shell-lobes to the mantle, and in the absence of lateral cusps to the teeth of the median band in the radula.

114. **Ratnadvipia irradians**, *Pfr.* (Vitrina) *P. Z. S.* 1852, p. 156; *id.* (Vitrina) *Mon. Hel.* iii, 1853, p. 3; *id. t. c.* vii, 1876, p. 14; *H. & T.* (Vitrina) *C. I.* 1876, p. 29, pl. 66, figs. 8, 9; *Godwin-Austen, Mol. Ind.* ii, 1898, p. 93, pl. 85, figs. 1–8 (animal & anatomy); *Collinge, Jour. Mal.* viii, 1901, p. 65, pls. 5, 6 (anatomy).

Shell imperforate or subperforate, depressed, thin, diaphanous, dull brownish horny above, striated and decussated with rather uneven impressed lines, rather paler, smooth, and polished beneath; spire scarcely raised, suture impressed; whorls 4, flattened above,

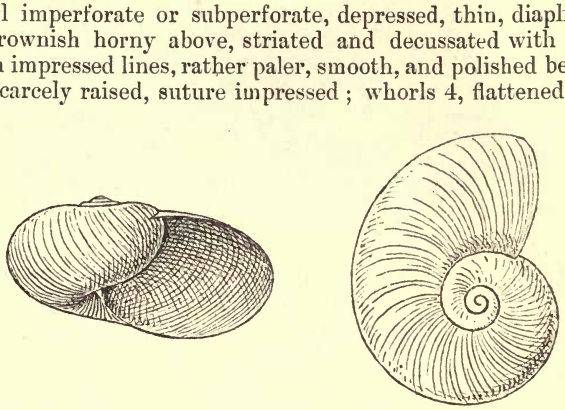


Fig. 39.—*Ratnadvipia irradians.*

rapidly increasing, the last much broader than the others, rounded at the periphery, convex beneath; aperture large, very oblique, lunately oval; peristome simple, thin, the upper margin arcuate, columellar margin regularly curved, briefly reflected close to the junction with the body-whorl.

Major diam. 24, min. 19, axis 11 mm.

Hab. South-western Ceylon, Kandy (*Collett*); Peradeniya (*Freeman*). There are specimens in the British Museum said to be from Southern India, but the locality is regarded as very doubtful.

115. **Ratnadvipia ? edgariana**, *Bs.* (Vitrina) *A. M. N. H.* (2) xii, 1853, p. 93; *Pfr.* (Vitrina) *Mon. Hel.* iv, 1859, p. 792; *Nev.* (Helicarion) *Hand-l.* i, 1878, p. 15.

"Shell much depressed, very thin, membranaceous beneath, highly polished, pellucid, striated obsoletely and obliquely above, ornamented by a few impressed spiral lines, yellowish horny; spire rather flat, apex prominent, suture impressed; whorls 3, rapidly increasing, somewhat flat, the last very convex at the periphery; aperture oblique, ovately lunate.

"Major diam. 10, minor 8, height 4 mm." (*Benson*, in Latin.)

Hab. At Colombo, Hangwelle, and Ratnapura in the island of Ceylon.

It is very difficult to form any idea of the affinities of the present species. The presence of spiral impressed lines may indicate a relationship with *R. irradians*. Unfortunately no specimens are available for examination.

[Ova of *Ariophanta lævipes*, Müll. (*vide* p. 29).

"Citron-yellow in colour, quite soft, enclosed in a skin, which is slightly loose like a bladder ¾ filled, having a tendency to assume the form of a prolate spheroid with deep furrows running from end to end throughout. Length about 5–6 mm., diam. 4–4½. Probably all Ariophantas have similar ova."—*Extract from Dr. W. T. Blanford's Note-book.*]

[Subfamily MACROCHLAMYINÆ.

Macrochlamyinæ, *Godwin-Austen, Mol. Ind.* i, 1888, p. 253; ii, 1907, p. 170.

Shells of very varied form; shell-lobes present in some genera; the free cæcum near the retractor muscle of the penis the principal distinguishing character, this being, in most cases, more or less closely wound. Amatorial organ in some species absent. These are given subgeneric rank.]

Genus **MACROCHLAMYS.**

Macrochlamys, *Benson, J. A. S. B.* i, 1832, pp. 13, 76; v, 1836, p. 350 (no description); *Gray, P. Z. S.* 1847, p. 169; *Stoliczka, J. A. S. B.* x, 2, 1871, p. 246; *Nevill, J. A. S. B.* l, 2, 1881, p. 131; *Godwin-Austen, Mol. Ind.* i, 1883–88, pp. 76–92, 97–122, 209–215; *id. t. c.* ii, 1899, 1907, pp. 87–90, 136–137, 151–170.

Nanina, *Gray*, partim, *P. Z. S.* 1834, p. 58; *Benson, t. c.* p. 89; *id. Zool. Journ.* v, 1835, p. 458; *Nevill, J. A. S. B.* l, 2, 1881, p. 131, *nec Risso.*

Tanychlamys, *Benson, P. Z. S.* 1834, p. 89.

"Orobia," *Albers, Heliceen*, ed. 2, 1860, p. 57.

Type, *M. petrosa*, Hutton.

Range. South-eastern Asia, including the whole Indian Empire except the dry regions of North-western India.

Shell heliciform, perforate (rarely imperforate), depressed, sometimes subglobose or subturbinate, thin, horny, as a rule smooth and polished, especially beneath, occasionally distinctly, often microscopically, striated or decussately sculptured; aperture lunate; peristome thin, but in a few species internally labiate, columellar margin reflected at the perforation.

Animal large and active, and in the wet season scarcely retractile within the shell. Foot narrow, the sole divided, by the arrangement of the muscles, into three parts, a median and two lateral areas, often distinguished by slight differences of colour. The mucous pore at the posterior extremity of the foot is large and overhung by a fleshy horn-like process, sometimes of considerable length; peripodial grooves well developed and double, the shallow grooves on the surface of the foot above the peripodial groove radiate from the shell, those on the back of the neck and back and

sides of the head forming a distinct tract. Lobes of the mantle well developed, the *right and left shell-lobes both present, short or elongate and generally pointed, extending in some species nearly or quite to the apex of the shell, and constantly in motion.*

[The left shell-lobe has been found absent in *M. atricolor* from the Munipur Hills.

In the genitalia, commencing at the generative aperture, the penis-sheath is a moderately long cylindrical tube (larger near the aperture) as far as the sharp bend at the epiphallic portion; the tube continues thence to the retractor-muscle attachment, and so far it may be compared with the male organ of *Ariophanta*. It is continuous still further, *forming a closely-coiled cæcum, the coil more or less conspicuous or becoming an indistinct muscular mass.* In three species from Sikkim the cæcum is long, free, and uncoiled, probably an early stage in its development. The retractor muscle attachment, in this case, is at the basal end of the cæcum; the epiphallus is short. The kalc-sac is close to the junction with it of the vas deferens, and is either a long flagellum, a short diverticulum, or a blunt knob. The dart-sac or amatorial organ is usually large, long, and cylindrical, the dart muscular. The spermatheca is elongate, more or less club-shaped, sometimes with a bulbous termination; its shape is necessarily dependent on whether it is empty or containing one or more spermatophores.]

The coiled cæcum is replaced in *M. pedina* &c. by a simple diverticulum, to the end of which the retractor muscle is attached as in *Ariophanta*. [This is a doubtful species of the genus.]

Odontophore: teeth of similar type to those of *Ariophanta*; the rhachidian (central) teeth tricuspid; the admedians broad, 10–30 in number, about 100 to 160 in the row, bicuspid or partly (the inner teeth) tricuspid, the inner cusp disappearing on the outer teeth; outer laterals narrow and usually with two cusps throughout, either both terminal or one on the outside occasionally lower down. [In some species the end of each lateral tooth is merely notched; in a few it is aculeate.]

There has been considerable discussion as to the generic term *Macrochlamys*. It was first published by Benson in 1832, and also a specific name *M. indica*, but no description was given, and in 1834 it was replaced by *Tanychlamys*, also undescribed, said to be the same as Gray's *Nanina*. In 1847 Gray adopted *Macrochlamys*, Benson, as a subgenus of *Stenopus*, *Ariophanta* and *Nanina* being other subgenera, and he named *Helix vitrinoides* as the type species of *Macrochlamys*. The shell probably, and the mollusc certainly, called *Helix vitrinoides* by Gray was an Indian species, and, as nearly as can be determined, *M. petrosa* or *M. perplana*. According to the rules of nomenclature generally adopted, the term must be accepted as dating from Gray's quotation of it in 1847. The *Orobia* of Albers is identical, being also founded on the supposed *H. vitrinoides* from India [which at that time included many different species in Bengal and even *pedina* of Bombay].

Macrochlamys comprises many of the commonest Indian snails, and species abound in the damper parts of the country. The described forms are very numerous, and a great number are undescribed, but the differences in the shells are so small that in many cases the species cannot be readily distinguished by descriptions or even by figures. Several of those already described and named will very probably never be identified again. [The species are far better, even easily, distinguishable the one from the other by the animal, its external characters and internal anatomy. Owing to their many enemies and changes from excessive moisture to great dryness, it is difficult to find shells of mature size; on the other hand, the immature are abundant, and thus new species have in so many cases been created on them; but sooner or later the adult forms turn up.]

Because of the difficulty of recognizing the different forms, the species are here arranged according to locality. The microscopic sculpture, to which attention has been particularly directed by Lt.-Col. Godwin-Austen, often affords a means of identification.

[In the Journ. Asiat. Soc. Bengal, vol. iii, p. 83 (Feb. 1832), Capt. Thos. Hutton describes the Mirzapur shell and gives a good description of the animal, which is recorded from low hills near Mirzapur, as *H. petrosa*, mihi; he mentions the "two narrow, flat, gradually pointed filaments or tentacula, which, when the animal is in motion, are kept constantly playing over the surface of the shell." To Hutton, therefore, and not to Dr. Gray, belongs the credit among English naturalists of having first described the animal of this genus and noted the great difference between the European and Asiatic forms of *Helix* as then constituted.]

A. Species from Himalayas west of Nepal.

a. *Subglobose or subglobosely depressed, not labiate.*

116. **Macrochlamys vesicula**, *Bs.* (*Hutton MS.*) (Nanina) *J. A. S. B.* vii, 1838, p. 216; ? *id.* (Helix) *A. M. N. H.* (2) ix, 1852, p. 406; *Hutton* (Nanina), *J. A. S. B.* vi, 1837, p. 931; *Pfr.* Helix (Nanina) *Mon. Hel.* i, 1837, p. 48; *id. t. c.* iii, 1853, p. 47; *H. & T.* (Helix) *C. I.* 1876, pl. 63, figs. 5, 6; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 25.

Shell perforate, subglobosely depressed, thin, smooth, translucent, vitreous, pale, almost whitish horny; spire low, apex acuminate, suture impressed; whorls 6, convex above, the last larger, well-rounded at the periphery and tumid beneath; aperture very slightly oblique, roundly lunate, about as high as broad; peristome very thin, in one plane, columellar margin much curved, vertical above and triangularly reflected at the perforation.

[Hutton and Benson's original description should be referred to. The shell to which this description applies, drawn up by Dr. Blanford, cannot now be picked out from among those under the name

vesicula in his collection. It may have been made from the shells named *vesicula* at Cambridge, or in the Natural History Museum.]

Major diam. 14, min. 12½, height 7 mm.

Hab. Near Simla and Mussooree up to about 10,000 feet (*Hutton*); I have also specimens from Murree. According to Benson, various shells from the plains of India (Rájmahál &c.) belong to this form, and it was upon these specimens that his description of 1852 was founded; but the typical form described in 1838 was Himalayan and apparently from Simla. Hutton also referred to *Helix vesicula* shells found by him between Mhow and Neemuch. These forms from the lowlands of Northern India require recomparison with the Himalayan type. The *Nanina* (*Macrochlamys*) *vesicula* of Nevill's Hand-list, i, p. 25, from Rájmahál and Pareshnath, is probably, as suggested, *M. lecythis*.

M. vesicula is distinguished from *M. subjecta* (p. 98) by its lower spire, smaller last whorl, and less broad aperture, and generally by higher lustre and paler colour.

[It is possible *vesicula* of 1838 was *M. glauca*: only the collection of a good series of shells of this type from the Simla and Mussoorie Hills at different elevations can settle this point *.]

117. **Macrochlamys glauca**, *Bs. MS.*; *Pfr.* (Helix) *Symb.* iii, 1846, p. 65; *id.* (Helix-Nanina) *Mon. Hel.* i, 1837, p. 48; *H. & T.* (Helix) *C. I.* 1876, pl. 63, fig. 10; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 25.

Shell obtectly perforate or subperforate, conoidly subglobose, smooth, polished, whitish horny; spire low conoid, suture impressed; whorls 5½, convex, the last broader, rounded externally and beneath; aperture subvertical, roundly lunate, broader than high; peristome thin, in one plane, columellar margin vertical above and expanded, almost closing the perforation.

Major diam. 11½, min. 10, height 7 mm.

Hab. Western Himalayas; Almorah, Naini Tal; Mussooree, Kotgarh near Simla.

A smaller shell than *M. vesicula*, with a larger mouth and the perforation nearly closed.

[Specimen from Bhim Tal (*N. Annandale*).—Shell: major diam. 8 mm. Animal: very pale-coloured in spirit, with some fine mottling near the extremity of the foot. A small tongue-shaped right shell-lobe and very small left shell-lobe. The penis, which is only 1·54 mm. in length, shows the coiled cæcum very distinctly. The radula is as usual; the laterals evenly bicuspid, the last 3 or 4 on the margin with a pectinate edge.

Formula: 35 . 2 . 10 . 1 . 10 . 2 . 35.

The species has similar habits to those of *Limax*.

Mr. Annandale, of the Indian Museum, Calcutta, writing to me from Bhim Tal, describes seeing one hanging by a thread of slime, about 15 feet long, proceeding from the posterior extremity of the foot.]

* [See remarks at end of genus.]

118. **Macrochlamys nuda**, *Pfr.* (Helix) *P. Z. S.* 1852, p. 83; *id. Mart. & Chemn. Syst. Conch.-Cab.* ed. 2, Helix, no. 1102, pl. 161, figs. 16, 17; *id.* (Helix) *Mon. Hel.* iii, 1853, p. 48; *H. & T.* (Helix) *C. I.* 1876, pl. 31, figs. 7, 10; *Nevill, Hand-l.* i, 1878, p. 25.

Shell scarcely perforate, depressedly subglobose, thin, smooth, translucent, pale fulvous horny; spire conoid, suture impressed: whorls 6, convex, the last broad, rounded at the periphery, inflated beneath; aperture nearly diagonal, roundly lunate, broader than high; peristome thin, margins converging, the right margin arcuate above, columellar curved, vertical above and rather broadly reflected.

Major diam. 11, min. $9\frac{2}{3}$, height 7 mm.

Hab. Western Himalayas, Kumaun, Mussooree, Simla (*Stoliczka*, teste *Nevill*).

The above description is chiefly taken from Pfeiffer, as no adult shell is available. This form only appears to differ from *M. glauca* in colour and in the obliquity of the mouth; if the latter character is due to age, as is probable, the two may be varieties of one species.

119. **Macrochlamys kuluensis**, *Blf.* (*Nevill, MS.*) *P. Z. S.* 1904, ii, p. 442, pl. 25, fig. 5.

Shell openly perforate, subumbilicate, depressedly subglobose, thin, translucent, smooth, pale horny; spire conoidal, suture impressed; whorls $5\frac{1}{2}$, convex, the last much larger, broadly rounded at the periphery and tumid beneath; aperture oblique, roundly lunate, about as broad as high; peristome thin, in one plane, columellar margin vertical and triangularly reflected above.

Major diam. 12, min. $10\frac{1}{2}$, height 7 mm.

Hab. Kulu.

This is near *M. glauca* and *M. nuda*, but distinguished by its much more open perforation and rounder mouth.

B. Species from Eastern Himalayas (Sikhim and Western Bhutan).

a. *Labiate.*

120. **Macrochlamys tugurium**, *Bs.* (Helix) *A. M. N. H.* (2) x, 1852, p. 348; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 636; *id. t. c.* iv, 1859, p. 124; *H. & T.* (Helix) *C. I.* 1876, pl. 29, fig. 10; *Nev.* (Nanina) *Hand-l.* i, 1878, p. 80; *Godwin-Austen* (Macrochlamys), *J. A. S. B.* 1882, 2, p. 69, pl. 5, fig. 4; *id.* (Macrochlamys) *Mol. Ind.* i, 1883, pl. 19, fig. 2 (shell and animal), pl. 20, fig. 3 (details); *id. t. c.* ii, 1907, p. 151, pl. 104, figs. 1–7.

Shell perforate, depressedly conoid, sublenticular, thin, fulvous horny, dull and closely striated above and more distantly rugate, decussated with very fine impressed spiral lines, smoother and polished beneath; spire depressedly conoid, suture scarcely impressed; whorls 6, flattish, regularly increasing, the last not descending, angulate at the periphery, convex beneath; aperture

oblique, broadly lunate, with rather broad white labiation inside; peristome in one plane, acute, columellar margin curved, slightly expanded, briefly reflected above.

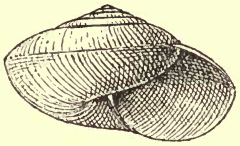


Fig. 40.—*Macrochlamys tugurium.*

Maj. diam. 21½, min. 18½, height 12 mm.

Hab. Sikhim, not rare about Darjiling, 4000′–7000′.

[The first two or three whorls of the shell show hardly any sculpture, thence a very finely decussate surface gradually follows, becoming strong towards the aperture; under a high power the cross-striation produces a close series of papillate dots.

Description of the animal. A specimen from Rissom Peak in the Daling District, east of the Teesta, which prior to 1864 formed part of the Bhutan State (4600 feet), is as follows:—Ochre throughout, the pedal margin very wide, sole of foot divided into three equal areas, a very large overhanging lobe at the extremity of the foot. There is a large right shell-lobe and a well-developed left shell-lobe; the right neck-lobe is small, the left neck-lobe rather narrow and succeeded after a short interval by another very small lobe close up to the left shell-lobe. The roof of the respiratory cavity is mottled sparsely with black. In a full-grown specimen from the same locality the colour was ochraceous, the peripodial fringe and sole of the foot with a green tinge. When the shell is removed a broad black band is conspicuous near the rectum, the membrane of the visceral sac covering the branchial cavity is speckled and streaked all over, and one large longitudinal streak occurs on about the middle line; while the integument covering the renal organ is black, forming a second, more posterior, brownish streak. There is a long pointed lobe over the mucous gland. The right shell-lobe is large and tapering, the left is well developed, the dorsal lobes as before described.

The generative organs were not found at their full state of development: the animals were taken in the winter months, still there was quite sufficient to show all the important characters. In the male organ the retractor muscle is attached to a coiled cæcum and there is a moderately long flagellum. The amatorial organ is very long, also the spermatheca.

The jaw has a central projection.

The teeth of the radula are as is usual in the genus *Macrochlamys* as regards the centre tooth and admedians, the arrangement being as follows:—

33 . 2 . 12 . 1 . 12 . 2 . 33
47 . 1 . 47

The teeth from the 15th to the 18th inclusive have a cusp on the

outer side below the point; this cusp becomes rapidly very minute, and towards the margin the teeth are nearly aculeate, only a very minute notch indicating the cusp.]

121. **Macrochlamys mainwaringi**, *Godwin-Austen* (*G. Nevill, MS.*, Bensonia ?), *J. A. S. B.* 1882, p. 69, pl. 5, fig. 3 (animal); *Blf. Proc. Mal. Soc.* iv, 1901, p. 182.
Helix celox, *Theobald* (*Bs. MS.*), *J. A. S. B.* xxxii, 1863, p. 365 (no description).

Shell perforate, subturbinately depressed, pale fulvous, thin, horny, translucent, dull and not polished above, striated obliquely and minutely decussated with spiral impressed lines, which disappear on decortiated shells, smoother and polished beneath; spire depressedly conical, suture slightly impressed; whorls 6–7, regularly increasing, the last rounded at the periphery; aperture moderately oblique, broad, lunate; peristome sharp, with a white labiation inside, similar labiation, marked by white bands, often found in the last whorls, marking the position of peristomes formed during growth.

Major diam. 27, min. 23·5, height 15·5 mm.

Hab. Sikhim: Darjiling, about 7000′; Kursiong.

Immature individuals often have a thin portion of the last whorl extending beyond the labiate peristome, which has evidently been formed during a period of rest, probably the winter.

The animal, as shown in Stoliczka's drawing figured by Godwin-Austen, is dull brick-red in colour, with a well-marked horn-like projection above the mucous pore. No shell-lobes are shown, but this may be due to their being small and inconspicuous. At the same time the lobes may be wanting, in which case this species should probably be referred to *Bensonia*.

122. **Macrochlamys dalingensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 121, pl. 35, figs. 1–10 (shell and anatomy); *Blf. Proc. Mal. Soc.* iv, 1901, p. 180.

Very similar to *M. mainwaringi*, but thinner, darker, and with the last whorl less tumid beneath the periphery, consequently the aperture is not so high; the sculpture too is rather stronger, consisting of fine, close, almost subcostulate striæ, decussated by fine impressed lines; the striæ nodose or papillate under the microscope between the intersections. The labiation inside the aperture appears to vary and is occasionally wanting.

Major diam. 24, min. 21, axis 12·5 ? mm.

Hab. Damsang, Daling Hills, Bhutan Duars, about 6000′; Sikhim, Singtam, about 5000′.

Animal pale-coloured (in spirits); shell-lobes both present, but not large. Radula normal, formula: 45 . 2 . 14 . 1 . 14 . 2 . 45; marginals almost simple, becoming unevenly bicuspid as they approach the admedian teeth. [In the generative organs the coiled cæcum is well seen, the epiphallus meeting the head of the penis close to and on side of it.]

123. **Macrochlamys opipara,** *Godwin-Austen, Mol. Ind.* i, 1883, p. 108, pl. 23, fig. 6.

Shell perforate, subglobosely depressed, less thin than most species of the genus, smooth and polished above and below, but with minute fine and close, shallow, longitudinal, impressed lines throughout, yellowish chestnut (horny in young specimens); spire low, conoidal, suture slightly impressed; whorls 6, convex, the last considerably broader, rounded at the periphery, moderately tumid beneath; aperture slightly oblique, roundly lunate; peristome thin, straight, with a distinct thickening a short distance inside the lip, columellar margin curved, oblique, reflected above, partly closing the perforation.

Major diam. $26\frac{1}{2}$, min. 24, height 15 mm.

A smaller specimen measures $17 \times 14\frac{1}{2} \times 12\frac{1}{2}$.

Hab. Sikhim: Kursiong, 4000′; Darjiling, 7000′; Tonghu, 10,000′.

Apparently not common. The adult form is one of the handsomest shells in the genus. Immature specimens have long been known and were regarded by Benson as a variety of *M. lubrica.*

[124. **Macrochlamys damsangensis,** *Godwin-Austen, Mol. Ind.* ii, 1907, p. 155, pl. 105, figs. 2–2*f*.

Shell depressedly globose, scarcely perforate, glassy; sculpture indistinct irregular longitudinal striæ, but quite smooth in places; colour rich sienna-brown, pinkish inside the aperture; spire depressed; suture shallow; whorls 4 (not quite fully grown), rather tumid and rapidly increasing; aperture subvertical, ovate, the peristome on outer margin nearly the curve of a true circle. Columellar margin weak, subvertical, scarcely reflected.

Size: maj. diam. 18·5, min. diam. 14·7; alt. axis 6·4, alt. body-whorl 6·8 mm.

Hab. Damsang Peak, Daling District, Bhutan Duars.

Animal. Has the typical shell-lobes of *Macrochlamys.* The specimen dissected was much contracted and hardened by the alcohol, so that the mucous gland and lobe above both appear small. The sole of the foot is strongly divided into middle and lateral areas. The peripodial groove is conspicuous and the margin broad. The membrane covering the pulmonary cavity is of a dark green colour, closely speckled, and above the renal organ and heart is quite black. The specimens were evidently taken in the cold season, for the generative organs were found to be exceedingly small and contracted and in trying to get them out were broken, yet sufficient was seen to show there was an amatorial organ and the general form of the penis. This shows a long kalc-sac or flagellum and a convolution where the retractor muscle is given off; it therefore agrees with the typical form of the cæcum in this genus, although its general form must be much altered and swollen during the season of reproduction.

The jaw has a central projection.
The radula formula is :

25 . 1 . 18 . 1 . 18 . 1 . 25 = 44 . 1 . 44

The central tooth is rather narrow, long, tricuspid; the admedian also on narrow plates, with one side cusp; the outer teeth are unevenly bicuspid. The breadth of the central portion is far greater than that of both the marginal parts.

This species, as regards its shell, may at a casual glance very easily be mistaken for *M. richilaensis*; it is, however, a much stronger shell and not so globose. The animals are very differently coloured, particularly in the distribution of colour; and there is great diversity in the generative organs.]

b. *Not labiate.*

a'. *Subturbinate.*

125. **Macrochlamys hodgsoni,** *Bs.* (*Blf. MS.*, Helix) *A. M. N. H.* (3) iii, 1859, p. 267; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 110; *H. & T.* (Helix) *C. I.* 1876, pl. 31, figs. 2, 3; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 38; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 159, pl. 109, figs. 1, 1 *a* (typical), 2–2 *d*].

Shell narrowly perforate, depressedly subglobose, thin, smooth, dull, very finely and closely decussated under the microscope with transverse and flexuous longitudinal striation, pale yellowish horny; spire conoidal, apex obtuse, suture impressed: whorls 5, convex, the last rather broader, rounded but very slightly compressed at the periphery, convex beneath; aperture slightly oblique, rather roundly lunate, broader than high; peristome thin, columellar margin much curved, vertical above, rather broadly triangularly reflected.

Major diam. 7, min. 6, height 4½ mm.

Hab. Sikhim, at low elevations; Pankabari, 1000′; [hills east of Teesta up to 10,000′].

[From the Richila Peak I have a large number, some very fine, with the same distinguishing sculpture. The largest measures 8 mm. in major diameter; and these fresh specimens are all of a brown-umber colour, with a slight green tint. I found only very young specimens preserved in spirit. Right and left shell-lobes are present, the last large. Extremity of foot with a long lobe. Visceral sac with 4 transverse narrow black streaks. Jaw with a central projection; in the radula the central and admedians are narrow and long, one cusp on outer margin; laterals bicuspid and even. Formula:

50 . 2 . 7 . 1 . 7 . 2 . 50 about
59 . 1 . 59]

b'. *Depressed.*

a². *Spirally (longitudinally) sculptured.*

126. **Macrochlamys sequax**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 270; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 118; *H. & T.* (Helix) *C. I.* 1876, pl. 63, figs. 1, 2, 3; *Nevill, Hand-l.* i, 1878, p. 23; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 166, pl. 106, figs. 1–1*d* (shell, genitalia, and radula)].

Shell perforate, depressed, thin, polished, microscopically decussated, almost papillosely, with striæ of growth and faint, close, waved, longitudinal, impressed lines, yellowish horny; spire low, the sides slightly concave, suture impressed; whorls 5, convex, rapidly increasing, the last broader, rounded at the periphery and beneath; aperture slightly oblique, broadly lunate, much broader than high; peristome thin, columellar margin curved, scarcely vertical above and briefly reflected.

Major diam. 18, min. 15, height 4 mm.

Hab. Darjiling, 4000′–7000′.

The animal has very broad shell-lobes to the mantle, almost covering the spire when extended, and the dorsal lobes also are very large; the surface of the mantle is coarsely granular.

[The material used in the following description was derived from several sources: the most reliable as regards this species from Dr. W. T. Blanford, collected by him at Darjiling and preserved in spirit; also the shells in his collection. When in Calcutta in 1877, Mr. G. Nevill placed in my hands a shell identified by him as *M. sequax*, which he had just received alive from Darjiling, sent by Colonel Mainwaring. I made a careful description of the animal at the time in my note-book, which I give below; but unfortunately, to make it complete, I did not retain the shell. At the same time I made a drawing, showing the form and position of the right shell-lobe and of the extremity of the foot. In Nevill's 'Hand-list,' p. 23, there is a note on the animal by Blanford: "A true *Macrochlamys*; animal pale, with back and tentacles black.—W. T. B." Next I had from Damsang, east of the Teesta River, some shells very similar in general appearance, but smaller than the type shell, which I at first took to be *sequax*; but on closer examination these differ in several particulars sufficiently to constitute a new species.

Description of the living animal received from Darjiling:—

Living animal of *sequax*? pale ochraceous throughout, including the mantle; a greenish tint on the neck, pinkish towards extremity of foot. Tentacles dark, from the base of which run two parallel dark lines towards the aperture. From the base of the lower tentacle a groove runs diagonally up towards the posterior of the neck. Mantle is slightly reflected over the peristome all round and to a greater extent on the lower margin, where on the left side, at about 0·35 inch or 9 mm. from the umbilicus, a small

tongue-like process (the left shell-lobe) is given off laterally. Close to the upper angle of the aperture a well-developed right shell-lobe is given off *horizontally* and is often extended for ·2 inch or 5 mm., *but never above the periphery of the shell.* The posterior part of the foot (in this example) was ornamented *with four diagonal lines*, which meet above in an angle; the general surface rugose; the peripodial margin broad and defined. The mucous gland overhung by a curved lobe. Length: head to shell 0·6 inch, extremity of foot to shell 0·75: total nearly 2 inches. Eye-tentacles long and slender, 0·4 inch.

The following notes were made when dissecting Dr. Blanford's specimen:—Shell: sculpture smooth, with indistinct fine spiral striation. Animal unicolor in spirit; peripodial margin broad. The right shell-lobe is a well-developed tongue-like process; the left shell-lobe small. The horn above the mucous gland of moderate size, blunt. Generative organs: penis with a rather long kalc-sac. The retractor muscle is short and thick, given off from quite a large coiled cæcum. The spermatheca is very long. The amatorial organ also very long. The radula was extracted nearly complete; formula:

$$\begin{matrix} 33 \,.\, 2 \,.\, 12 \,.\, 1 \,.\, 12 \,.\, 2 \,.\, 33 \\ 47 \,.\, 1 \,.\, 47 \end{matrix}$$

The admedian teeth have a single cusp on the outer side, the marginals are unevenly bicuspid, and those on the outside become very minute.

The jaw has a small central projection.]

[127. **Macrochlamys sequius**, *Godwin-Austen*, *Mol. Ind.* ii, 1907, p. 168, pl. 100, figs. 2–2*g*.

Shell differs in its characters from that of *M. sequax*; it is slightly more solid, globose, with more rounded apex, the major axis of the aperture directed obliquely downward, instead of horizontally as in *M. sequax*. The sculpture of these Damsang shells is rather coarse, somewhat wavy, longitudinal striation. Colour pale umber-brown. The shell of the specimen dissected had 4 whorls and was 11 mm. in major diameter, and therefore not fully grown.

The largest specimen measures: major diam. 12·25, alt. axis 5·75 mm.

Locality. Damsang, Daling Hills, W. Bhutan.

Animal in spirits with pale foot, black head and tentacles, and a slightly darker tint near the extremity of the foot. The right shell-lobe is rather short and broad; the left shell-lobe small; the left dorsal lobe is in two parts, one on each side of the left shell-lobe.

In the generative organs there is not much difference to be found when they are compared with those of *M. sequax*. The kalc-sac was well developed and shows a spermatophore within it.

The teeth of the radula are of the same form, the formula differing slightly: + . 20 . 2 . 10 . 1 . 10 . 2 . 20 +.

The jaw has a nearly straight edge with a slight central projection, and differs from *sequax* from Darjiling.]

[**Macrochlamys sequius**, *Godwin-Austen* (very young), *Mol. Ind.* ii, 1907, p. 168, pl. 109, fig. 7.

Shell depressedly conoid, umbilicated, glassy, rather solid; sculpture fine, but distinct and regular longitudinal striæ; colour pale sienna-brown; spire flatly conoid; suture shallow; whorls nearly 4, the last well rounded; aperture ovately lunate, subvertical; peristome slightly thickened, columellar margin very slightly reflected.

Size: major diam. 5·0, alt. axis 1·9 mm.

Locality. Darjiling (ex Coll. Calcutta Museum).]

128. **Macrochlamys superflua**, *Blf. P. Z. S.* 1904, ii, p. 442, pl. 25, fig. 7; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 162, pl. 109, fig. 6 (a very young shell)].

Shell perforate, depressed, thin, polished, microscopically marked with faint, subdistant, longitudinal (spiral), impressed lines above and often below, the spaces between the lines papillate, pale yellowish to brownish horny; spire low, suture well impressed;

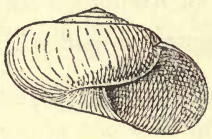


Fig. 41.—*Macrochlamys superflua.*

whorls 6, rather rapidly increasing, the last broader, rounded at the periphery and convex beneath; aperture slightly oblique, subovately lunate, broader than high; peristome thin, basal margin almost straight when viewed from below, columellar vertical above, then obliquely curved, rather broadly reflected at the perforation.

Major diam. 20, min. 17½, height 10 mm.

Hab. Sikhim. Common in the Upper Teesta Valley about Singtam (4000–5000′).

This somewhat resembles *M. sequax*, but is distinguished by larger size and different sculpture. It is also very much like immature shells of *M. lubrica*, but may be known by the presence of longitudinal sculpture, more numerous whorls, colour, &c.

[129. **Macrochlamys rakaensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 164, pl. 110, figs. 2–2 *b*.

Shell subdepressedly globose, very narrowly perforate; sculpture

well marked, fine, regular, longitudinal striation, showing even on the lower side; it is a far stronger striation than is seen in *M. sathilaensis*; colour pale ashy brown; spire flatly conoid; suture impressed. Whorls 5, not fully grown; aperture widely lunate, subvertical; peristome very thin; columellar margin subvertical, with slight reflection.

Size: maj. diam. 9·0, alt. axis 3½ mm.

The coil of the spire differs from that of *M. sathilaensis*.

Locality. Richila Peak, Bhutan frontier.

Animal. Pale-coloured throughout, with black head and the extremity of the foot tinged very slightly darker towards the tip of the overhanging lobe. Both the shell-lobes are very long, particularly the right, longer than in any spirit-specimen I have ever handled. The right dorsal lobe is small, the left in two parts. The lobe over the mucous gland is not very pointed. The visceral sac is umber-brown, sparsely mottled in front with black, and a long black streak next the renal organ.

Generative organs. The coiled cæcum is exactly like that of the typical species. The kalc-sac is long. The spermatheca long. The radula is like that of allied species in every way (only the central tooth and admedians seen): + . 2 . 10 . 1 . 10 . 2 . +]

b². *Smooth.*

130. **Macrochlamys lubrica**, *Bs.* (Helix) *A. M. N. H.* (2) x, 1852, p. 349; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 629; *id. t. c.* iv, 1868, p. 44; *H. & T.* (Helix) *C. I.* 1876, pl. 51, figs. 8, 9; *Godwin-Austen, Mol. Ind.* i, 1883, p. 118, pl. 24, fig. 7.

Shell perforate, depressed, smooth, polished, obsoletely striated, moderately thin, yellowish to brownish tawny; spire very low, sometimes almost flat, suture slightly impressed; whorls 5, convex above, the last rather broad, rounded at the periphery, moderately convex beneath; aperture broadly lunate, almost vertical; peristome acute, straight, basal portion sometimes slightly thickens and white inside, columellar margin curved, slightly reflected above.

Major diam. 26, min. 21, height 12 mm.

Hab. Sikhim, 4000–7000′. Not rare about Darjiling.

This shell may be known by its smoothness, its few whorls, and its broad last whorl. The animal has not been described.

a³. *Conoidly depressed, rugose, transverse (but no longitudinal) sculpture.*

131. **Macrochlamys patane**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 270; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 113; *H. & T.* (Helix) *C. I.* 1876, pl. 130, figs. 5, 6, 7; *Godwin-Austen, Mol. Ind.* i, 1888, p. 211, pl. 53, fig. 5 (shell).

Shell perforate, conoidly depressed, thin, pale horny or ochreous horny, translucent, dull and rugosely striated across the whorls

above, smooth and polished beneath, without longitudinal (spiral) sculpture; spire conoidal, apex blunt, suture impressed; whorl 6, convex, rather closely wound, the last rounded at the periphery, convex beneath; aperture oblique, rather roundly lunate, broader than high; peristome thin, columellar margin oblique, rather broadly reflected at the perforation.

Major diam. 10, min. 9, height 6 mm.

Hab. Darjiling.

Distinguished by its shape, rather narrow whorls, and rugose striation.

[132. **Macrochlamys ? perfragilis**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* ii, 1907, p. 161, pl. 109, fig. 5.

Nanina (Microcystis), n. sp. 5 (Sikhim; *coll. Dr. F. Stoliczka*), *Nevill's Hand-list*, no. 167, p. 39.

Shell globose, scarcely perforate, thin membranaceous character; sculpture very minute, fine regular longitudinal striæ; colour sapphire-green; spire low, apex rounded and blunt; suture very shallow; whorls 4½, rounded on side, flat above; aperture broadly lunate, vertical; peristome very thin, columellar margin scarcely thickened, subvertical.

Size: maj. diam. 7·0, min. 6·0, alt. axis 3·8 mm.

Locality. Sikhim.

This shell was sent as 167 A, as the type of *perfragilis*. There should be four specimens left in the Calcutta Museum.]

c. *With a free cœcum to male organ.*

[133. **Macrochlamys richilaensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 154, pl. 105, figs. 1–1 *g*.

Shell subdepressedly globose, very narrowly perforate, glassy surface, very transparent; sculpture none, transversely crossed by regular shallow close furrows; colour greenish ochre; spire depressed; suture shallow; whorls 4, rather rapidly increasing, showing at intervals 3 varices of progressional growth; aperture subvertical, widely lunate; columellar margin subvertical, not thickened and scarcely reflected. The aperture was covered with a thick membranaceous epiphragm.

Locality. Richila Pass, Bhutan frontier (10,370 ft.).

Size: maj. diam. 18·75, min. 14·75, alt. axis 8·5 mm.

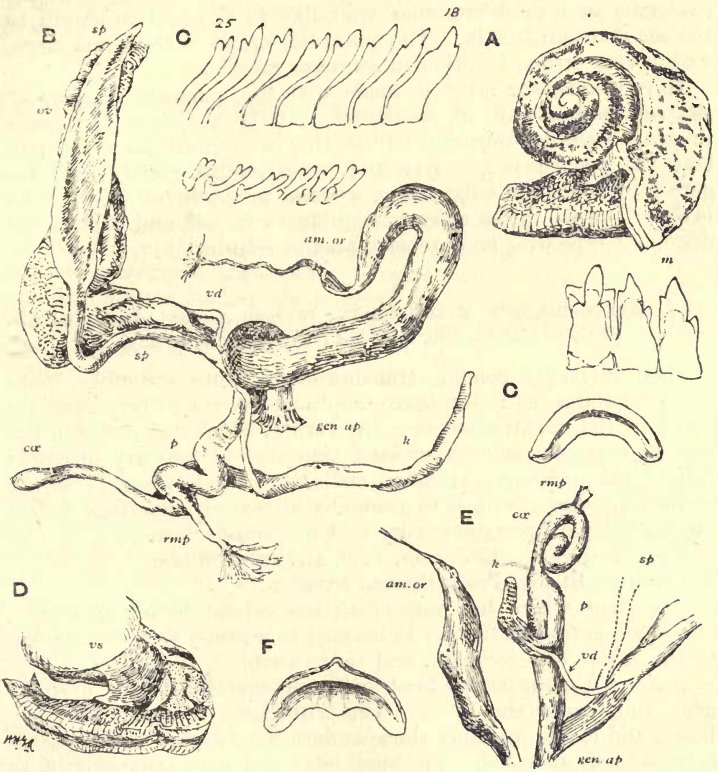
The animal is dark green near the extremity of the foot. The margin as well as the sole of the foot is pale ochre in the spirit, probably ruddy ochre in life, quite a contrast to the upper part. Sole of foot divided. As regards the general form, mucous gland, and neck-lobes it is very like *M. dalingensis*. The apical whorls of the visceral sac are black, sparsely speckled with ochre: where the membrane covering the heart and kidney commences this colouring is reversed; the ground is pale, openly speckled over with ovate black markings and dots, with an undefined band of

same colour near the mantle-zone. A loop of the intestine is defined in black.

The jaw has no central projection.

The radula is nearly the same as in *Dalingia bhutanensis*, only that the marginal teeth are much more evenly bicuspid.

$$\frac{24 \cdot 2 \cdot 18 \cdot 1 \cdot 18 \cdot 2 \cdot 24}{44 \cdot 1 \cdot 44}$$



[Fig. 42.—*Macrochlamys richilaensis.*

A. Animal from spirit-specimen, shell removed, showing the right shell-lobe, &c. × 2.
B. Generative organs. × 3·4.
C. Jaw, × 12, and teeth of radula at different parts of the row, × 276.

Macrochlamys zemoensis.

D. Animal from a spirit-specimen, seen from the right side, shell removed. × 3·4.
E. Genitalia, incomplete, amatorial organ detached. × 9.
F. Jaw. × 16·5.]

The generative organs present very remarkable variation from typical *Macrochlamys*, particularly in the form of the penis. The kalc-sac is very long, quite a flagellum, and *close to where the retractor muscle is given off there is a long free cæcum loosely coiled; this undoubtedly represents the closely-wound cæcum in the type species, to the side of which the retractor muscle is usually attached. In this species the cæcum is quite free, the retractor muscle rising at the base of the cæcum itself.* The spermatheca is also very long and abnormal in form, consisting of a capacious thin-walled sac at the extremity of a thick muscular stalk-like tube, equal in length to the sac it terminates in. The amatorial organ is thick and large, with a very strong lengthened retractor muscle.

Here comparison must be made with the generative organs of *M. sathilaensis* and *M. zamoensis*. In both species the penis presents a similar departure from that of typical *M. indica*; in both the *penis cæcum* is free and loosely coiled, merely kept together by a few muscular fibres, whereas in *M. indica* this cæcum is closely coiled into a mass impossible to unroll, and this is the dominant type over an extensive area of country.]

[134. **Macrochlamys sathilaensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 169, pl. 106, figs. 4–4 *c* (shell and anatomy).

Shell globosely conoid, translucent, delicate structure, narrowly umbilicated; sculpture confined to some very delicate fine longitudinal striation near the suture, which dies out, and the rest is perfectly smooth, crossed transversely by wavy furrows; colour pale ochraceous; spire moderately high, conoid; suture moderately deep; whorls 6, gradually increasing; aperture widely lunate, oblique; peristome very seldom quite perfect.

Size: maj. diam. 13·5, min. 12·0, alt. axis 6·5 mm.

Locality. Richila Peak, Bhutan frontier.

This shell, which has very much the coloration of *M. sequax*, differs altogether in form. It belongs to a group very similar one to the other, very common, and very variable with locality.

Animal. Colour throughout pale; no markings, only a slight grey tinge near the head. The withdrawn tentacles are very black, and in life probably show as dark lines on the neck; pallial margin finely streaked. The shell-lobes and extremity of foot as in *M. sequius* from Damsang; and the radula is of the same type exactly:

$$+\ 31\ .\ 2\ .\ 11\ .\ 1\ .\ 11\ .\ 2\ .\ 31\ +$$
$$+\ 44\ .\ 1\ .\ 44\ +$$

The smaller teeth near the margin would add another 10 or 15 to the above, or about 90 in the row.

The jaw is well arched, with a large central projection.

The visceral sac is closely mottled, and shows dark inside the shell.

The penis is quite different from that of *sequax*; *the cæcum, instead of being closely coiled, is free, similar in size and length to the kalc-sac*; the epiphallus is very short, and just below the retractor muscle there is a globose enlargement of the penis-tube. The amatorial organ is long. *In the free cæcum the male organ may be compared to the similar character found in M. richilaensis.*

This species was also obtained in the Risetchu Valley, and is represented by eight specimens, some of which are rather flatter in the spire than the type. Three specimens are from Rissom Peak.]

[135. **Macrochlamys zemoensis,** *Godwin-Austen, Mol. Ind.* ii, p. 164, 1907, pl. 100, figs. 1-16 (shell, animal, and anatomy).

Shell globosely conoid, glassy, fragile, narrowly umbilicated; sculpture quite smooth; whorls transversely crossed by wavy furrows of growth, here and there traces of longitudinal striæ under high power; colour ochraceous with an olive tint, some more sienna-brown than others; spire rather depressed, apex rounded; suture moderately impressed. Whorls 5, regularly increasing; aperture broadly lunate; peristome very thin; columellar margin weak, scarcely reflected.

Size: maj. diam. 10·0, min. 9·0; alt. axis 4·5 mm.

Locality. Zemo Samdong, Sikhim, valley of the Lachen, about 12,000 feet. In the pine-forests.

Animal with a dark-coloured broad margin to the foot, pale on the keel of same, the pallial fringe broad; the lobe over the mucous gland long and pointed; sole of foot well divided. The right shell-lobe is large, rather broad at base. There is a small narrow left shell-lobe and the left dorsal lobe is in two separate parts. The visceral sac is sparsely spotted near the suture, with a black band bordering the mantle-zone, and a long black band runs parallel to the renal organ. The salivary glands are in one compact mass.

Genitalia. The penis-muscle is attached to a coiled free cæcum, as I have noticed in *M. richilaensis*; there is a short flagellum where the vas deferens joins. The amatorial organ is moderately long and straight.

The jaw has a central projection.

The radula formula is

$$\begin{matrix} 35 \,.\, 1 \,.\, 9 \,.\, 1 \,.\, 9 \,.\, 1 \,.\, 35 \text{ to } 40 \\ 45 \,.\, 1 \,.\, 45 \end{matrix}$$

The centre tooth is tricuspid; the admedian teeth have a very small inner cusp high up on inside and a larger one lower down on the outside; the marginal teeth are bicuspid, the outer cusp below the main one.]

d. *Shells not exceeding* 6 *mm.*

b³. *Longitudinally striated or sculptured.*

136. **Macrochlamys rorida**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 266; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 111; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 38; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 160, pl. 109, figs. 3, 3 *a*, 3 *b* (shell, foot, and mantle-zone).]

Shell subperforate, globosely depressed, very thin, smooth, polished, with traces of longitudinal striation under the microscope, not always to be detected, but best seen on the penultimate whorl above and around the perforation beneath, tawny horn-coloured; spire low, conoidal, suture impressed; whorls $4\frac{1}{2}$, convex, the last considerably broader, rounded at the periphery, convex beneath; aperture large, oblique, roundly lunate; peristome thin, the right margin slightly arcuate above, columellar much curved, vertical in the middle, curving towards the right margin above, and briefly but rather broadly reflected, so as almost to close the perforation.

Major diam. 5, min. $4\frac{1}{2}$, height $3\frac{1}{2}$ mm.

Hab. Darjiling, and Senchal Mountain near Darjiling, 7000–8000′.

The animal was found creeping on shrubs; it has long mantle-lobes and a large lobe above the caudal gland, colour pale. The shell may be recognized by its subglobose form.

[From specimen preserved by Dr. W. T. Blanford:—Animal dark-coloured above; sole of foot and the outer peripodial margin pale in contrast; between the peripodial grooves dark-coloured, as well as the segmental divisions above. Horn above mucous pore well developed. The left shell-lobe and right shell-lobe both long and tongue-like; the left dorsal lobe rather small and narrow.

A fine specimen from Rissom Peak, W. Bhutan, measures in major diameter 8 mm. and is dark green in colour.]

b⁴. *Smooth.*

137. **Macrochlamys? darjilingensis**, *Nevill, MS.*; *Godwin-Austen, Mol. Ind.* i, 1883, p. 88, pl. 17, fig. 11.

Shell imperforate, depressed, solid, smooth, polished, glassy, transversely striated, without longitudinal sculpture, translucent, whitish; spire convex, suture very shallow; whorls 5, convex above, the last rounded at periphery, moderately convex beneath; aperture subvertical, lunate; peristome obtuse, basal margin arcuate, columellar slightly oblique, much curved, reflected throughout.

Major diam. 1·5, min. 1·3, height 0·8 mm.

Hab. Darjiling.

C. Species from the Gangetic Valley and Delta.

a. *Depressed or conoidly depressed.*

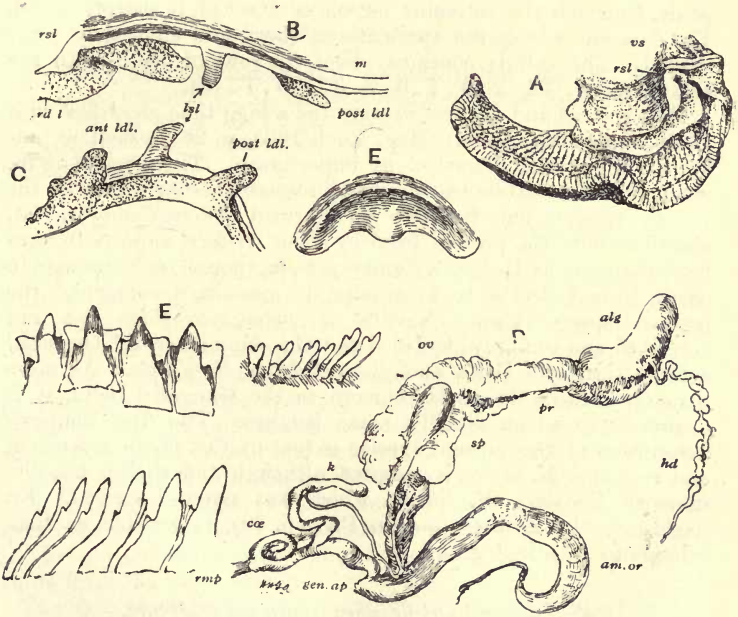
138. **Macrochlamys indica**, *Godwin-Austen.*

? Helix vitrinoides, *Pfr. Mon. Hel.* i, 1847, p. 56; *id. t. c.* vii, 1876, p. 108, pt.; *id. in Mart. & Chemn. Syst. Conch.-Cab.* ed. 2, 1850, pl. 110, figs. 13, 14, 15; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 20: *nec Desh.*

Macrochlamys indica, *Stol. J. A. S. B.* 1871, p. 246 (no description); *Godwin-Austen, Mol. Ind.* i, 1883, pp. 76, 97, pl. 18, figs. 1-8 (shell and anatomy), pl. 21, fig. 7 (sculpture), pl. 25, figs. 9, 16 (mantle-lobes) (1883): *nec Benson.*

Nanina (Macrochlamys) pseudovitrinoides, *Nevill, J. A. S. B.* 1881, p. 132 (no description).

Shell perforate, depressed, smooth, polished throughout, translucent, pale brownish tawny, not distinctly striated, but with



[Fig. 43.—*Macrochlamys indica.* × 3.

A. Right side of animal from a spirit-specimen, shell removed.
B. Edge of mantle, front view, showing shell-lobes and dorsal lobes.
C. Ditto, viewed from below.
D. Genitalia. × 3.
E. Jaw and teeth of the radula. ×270.]

microscopic longitudinal impressed lines, slightly flexuous and not close together; spire low, conoid, suture slightly impressed;

whorls $5\frac{1}{2}$, slightly convex above, the last not descending, rounded at the periphery, moderately convex beneath; aperture slightly oblique, broadly lunate; peristome thin in one plane, the columellar margin curved, oblique, never quite vertical, carried forward and briefly reflected above.

Major diam. $18\frac{1}{2}$, min. 16, height $8\frac{1}{2}$ mm.

Hab. Lower Bengal, common at Calcutta. This species is also said to be found in Sylhet to the eastward and in Orissa to the south; other reported localities are more doubtful. I have seen shells closely resembling *M. indica* from Karnul and from Ceylon, but the sculpture is finer and indistinct.

Animal purplish grey not black, elongate; "the right shell-lobe small, the left is narrowly reflected over the edge of the peristome, and at the basal side gives off a short tongue-like process"; right dorsal lobe narrow and elongate, the left in two distinct portions. In the genitalia a moderately long cylindrical blunt kalc-sac is given off at the junction of the vas deferens, and the cæcum of the penis, to which the retractor muscle is attached, is sharply coiled. The dart-sac is long, the spermatheca short and elongately pear-shaped. The radula contains about 88 rows of teeth, with the arrangement: 34 . 2 . 9 . 1 . 9 . 2 . 34 (45 . 1 . 45).

This species and *M. petrosa* were for a long time identified with *Helix vitrinoides*, Desh. (Mag. Zool. 1831, p. 26), a shell of unknown origin and described as imperforate. The original figure given of *H. vitrinoides* has no great resemblance to either of the Indian species, but Benson's undescribed *Macrochlamys indica*, identified with the present form by some writers, appears to have been the same as Hutton's *Nanina petrosa*, though, as it was said to occur from Calcutta to Cawnpore, it may have comprised the present species also. Nevill's *N. pseudovitrinoides* was not described and was only identified as "the common snail" throughout the Gangetic Delta and distinct from *N. petrosa*. As more than one *Macrochlamys* is common in the Gangetic Delta, it is uncertain to which Nevill's name belongs. The first complete description of the present species is that by Col. Godwin-Austen, and his name *M. indica* is accepted, although the shell is not the same as Benson's *M. indica*, which was never described. No confusion with *Euplecta indica*, Pfr. (p. 60), is possible, as that belongs to a distinct genus.

a'. *Longitudinal flexuous impressed sculpture.*

139. **Macrochlamys petrosa**, *Hutton* (Helix?), *J. A. S. B.* iii, 1834, p. 83; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 56; *Bs.* (Helix) *A. M. N. H.* (2) ii, 1848, p. 163; *H. & T.* (Helix) *C. I.* 1876, pl. 88, figs. 7, 10, pp. viii, 37; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 21; *Godwin-Austen, Mol. Ind.* i, 1883, pp. 96, 99, pl. 19, figs. 1, 1 *a* (animal), pl. 21, fig. 2 (sculpture), pl. 22, fig. 1 (shell).

Helix (Macrochlamys) indicus, *Bs. J. A. S. B.* i, 1832, p. 76; a mere name, without description.

Nanina vitrinoides, *Bs. J. A. S. B.* v, 1836, p. 350; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 62, pt.; *id. t. c.* vii, 1876, p. 108, pt.: *nec Deshayes.*

Shell very similar to that of *M. indica*, but broader in proportion to the height, the spire lower, and the lower surface more excavated around the perforation, which is larger. The mouth is decidedly broader in proportion to its height; as a rule, too, the size is larger and the surface is more polished. Longitudinal sculpture faint and often obsolete; when visible it resembles that of *M. indica*.

Major diam. 21, min. 18, height 9 mm.

Hab. The country south of the Gangetic plain from Rájmahál to Bundelkhand, especially on hills at Rájmahál, Patharghatta, near Mirzapur, &c.

The animal is dark brown or blackish; both shell-lobes long and pointed; the lobe above the mucous gland very tapering and pointed.

b'. *Very fine microscopic striæ.*

140. **Macrochlamys hardwickii**, *Godwin-Austen, Mol. Ind.* i, 1883, pp. 105–107, pl. 21, fig. 10 (sculpture), pl. 23, figs. 1–4 (shells), pl. 28, figs. 1, 1 *a*, 1 *b* (anatomy).

Macrochlamys hardwickii, var. politulus, *Godwin-Austen, l. c.* p. 107.

Macrochlamys sylhetensis, *Godwin-Austen, Mol. Ind.* i, 1883, p. 94, pl. 21, fig. 9 (sculpture only, no description).

[*Vide* fig. 51 B, p. 133. Genitalia and teeth of the radula.]

Shell perforate, conoidly depressed to depressed, thin, tawny, with a rather dull, greasy lustre above, more polished beneath, very minutely and closely striated longitudinally, the striæ only visible under a microscope; spire low, conoidal, suture slightly impressed; whorls 6, convex, the last broader, rounded at periphery, convex beneath; aperture slightly oblique, roundly lunate; peristome thin, in one plane, columellar margin curved, vertical above, and rather broadly reflected at the perforation.

Major diam. 16, min. 14, height 9 mm.

Hab. Lower Bengal, Sylhet, and Western Assam. Typical specimens were obtained in Calcutta. Shells from Upper Assam are, as a rule, rather larger and flatter and are more vitreous. These form the var. *politula*.

The shell of *M. indica* is not easily distinguished except by its coarser and much less close longitudinal sculpture; generally it is rather larger and flatter.

The animal differs from that of *M. indica* in several particulars. The body and tentacles are pale grey, the mantle pale ochraceous. The shell-lobes are smaller. The spermatheca and kalc-sac are both considerably longer and the form of the penis is different. The radula contains about 109 rows of teeth, arranged thus: 50 . 1 . 12 . 1 . 12 . 1 . 50 (63 . 1 . 63).

b. *Smooth.*

141. **Macrochlamys subjecta**, *Bs.* (Helix) *A. M. N. H.* (2) ix, 1852, p. 407 ; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 48 ; *H. & T.* (Helix) *C. I.* 1876, pl. 64, figs. 1, 2, 3 ; *Nevill, Hand-l.* i, 1878, p. 25.

Shell subobtectly perforate, conoidly depressed (subglobose), very thin, smooth, with a rather oily lustre above, more vitreous beneath, pale yellowish amber to yellowish tawny in colour ; spire low conoidal, apex rather acute, suture impressed ; whorls 6–6½, convex above, the last considerably broader, well rounded externally and beneath ; aperture slightly oblique, roundly lunate, broader than high ; peristome very thin, in one plane, columellar margin much curved, becoming vertical near the perforation and triangularly expanded, but very little reflected.

Major diam. 16, min. 13, height 9 mm.

Hab. Rajmahal Hills ; Orissa ; Cuttack (*Theobald, W. T. B.*) ; Ganjam.

This species may be distinguished from its allies by its broader last whorl and larger and broader mouth.

[Animal from spirit-specimen (Rajmahal) pale in colour, with slight coloration near the extremity of the foot, which has a hooked overhanging termination. The right shell-lobe is moderately long, tongue-shaped, and attenuate, the left is very small : the left dorsal in two parts, overlapping. The generative organs were not in the active stage and were very small. A coiled cæcum is present in the penis, and the amatorial organ was observed. Teeth of radula of usual form, laterals evenly bicuspid. Formula : 48 . 2 . 10 . 1 . 10 . 2 . 48, or 60 . 1 . 60.

Jaw arched, with a central projection.]

142. **Macrochlamys lecythis**, *Bs.* (Helix) *A. M. N. H.* (2) ix, 1852, p. 406 ; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 47 ; *H. & T.* (Helix) *C. I.* 1876, pl. 63, figs. 8, 9.

Macrochlamys lecythis ?, *Godwin-Austen, Mol. Ind.* i, 1883, pl. 19, fig. 5 (animal) ; ii, 1899, p. 134, pl. 94, figs. 2, 2 *a*, 4 (spermatophore) [is another species].

Shell subobtectly perforate, conoidly depressed (depressedly subglobose), thin, polished, smooth, ochraceous horny, sometimes olivaceous ; spire conoid, slightly raised, suture deep ; whorls 5–6, convex, the last much broader, rounded at the periphery, moderately swollen beneath ; aperture oblique, elliptically lunate, decidedly broader than high ; peristome thin, straight, columellar margin oblique, triangularly reflected above.

" Major diam. 14, min. 13, height 8½ mm." (*Bs.*). An immature shell measures 11½ × 10 × 6½ mm.

Hab. Rajmahal Hills (*Bacon*) ; Parasnath ?

The typical form appears to pass into one with a rounder mouth and vertical columellar margin, Benson's *M. vesicula* from Bengal. The shells from Assam and the Assam Hills are much stouter than those from Western Bengal and may be a different species.

M. lecythis is known from *M. subjecta* and *M. vesicula*, Benson, 1852, by having the aperture distinctly wider than high. [I consider *vesicula*, Bs., 1852, = *lecythis*. This and *subjecta* are species so extremely close to one another that I doubt their distinctness. They cannot be matched with shells of this type from Assam and neighbouring hill-ranges.]

143. **Macrochlamys perplana**, *Nevill, MS.*; *Godwin-Austen, Mol. Ind.* i, 1883, p. 94 (no description), pl. 19, fig. 4 (animal from typical locality, Parasnath; copied from Stoliczka's drawings).
Macrochlamys jainiana, *Godwin-Austen, Mol. Ind.* i, 1883, pp. 111, 112, pl. 26, figs. 7, 8 (shells), pl. 28, figs. 2–2 *e* (anatomy); ii, November 1899, p. 134 (spermatophore).
? Nanina vitrinoides, *Strickland, P. Z. S.* 1848, p. 142, *Moll.* pl. 2, figs. 1, 2.
Nanina (Macrochlamys) n. sp., *Nevill, Hand-l.* i, 1878, p. 22, no. 23 [8 sp., Parasnath (*type*), *coll. Stoliczka*: with abridged description of animal taken from that by Stoliczka].
Macrochlamys stricklandi, *Godwin-Austen, Mol. Ind.* i, 1883, p. 82 (no description), pl. 26, fig. 8. [This shell, from Jeypur, differs much in form, and may prove to be distinct.]

Similar to *M. indica*, but more depressed and with the spire almost flat, the surface smooth, and the perforation larger; whorls 6, the last broader; aperture broadly lunate, columellar margin but little curved, oblique throughout, slightly expanded for some distance, more so at the perforation.

["*Macrochlamys* (Parisnath).—Shell of flattened form. Both mantle-lobes (*i. e.* shell-lobes) very long and narrow; mantle greenish, splashed with white. Whole body of a distinct greenish tinge; anterior part, especially on the pedicles and back, black; middle part pale; posterior part dark above, less dark at the sides." In Nevill's handwriting. "*N. perplana*, Nevill" (p. 4, fig. 11, 'Drawings of Land Mollusca executed under the Superintendence of the late Ferd. Stoliczka'). Indian Museum Library.]

Major diam. 20, min. 17, height 7½ mm.

Hab. Upper part of Parasnath Hill in Western Bengal (*W. T. B., Stoliczka*), Panchet Hill near Raniganj (*W. T. B.*), Manbhum (*V. Ball*); ? Madhopur, Jeypur (*Capt. A. B. Melville*).

Teeth in radula 27 . 15 . 1 . 15 . 27 (42 . 1 . 42) in a Parasnath shell; 38 . 12 . 1 . 12 . 38 (50 . 1 . 50) in one from Manbhum. The outer laterals are not, as in most allied species of *Macrochlamys*, bicuspid, but they are long and straight; those inside near the inner laterals have a minute notch near the apex; the inner laterals and medians bicuspid as usual, the outer cusp small.

D. Species from the Assam Hills, North and South of Valley.

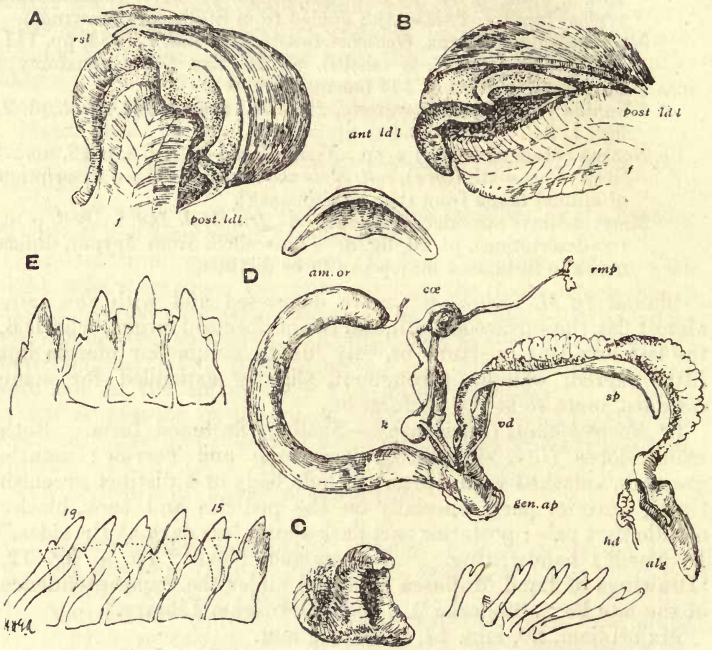
a. *Labiate.*

144. **Macrochlamys atricolor**, *Godwin-Austen* (Helix-Nanina) *J. A. S. B.* 1875, 2, p. 2, pl. 1, fig. 2; *Pfr.* (Helix) *Mon. Hel.* viii, 1877, p. 559; *Godwin-Austen, Mol. Ind.* i, 1883, pp. 113–117,

pl. 24, figs. 1–5 (shells), pl. 25, figs. 1–10 (animal), pl. 27, figs. 1 & 3 (anatomy and shell).

Nanina (Macrochlamys) resplendens, var. atricolor, *Nev. Hand-l.* i, 1878, p. 20.

Shell perforate, depressed, rather less thin than in most species of this genus, smooth, polished, colour varying from ochraceous horny or pale yellowish tawny to chestnut-brown; spire low, conoidal, suture slightly impressed; whorls 6, convex above, the



[Fig. 44.—*Macrochlamys atricolor.*

A. Part of animal, spirit-specimen, showing mantle- and shell-lobes. × 1·8.
B. Ditto, viewed from left side. × 1·8.
C. Extremity of foot, viewed from behind. × 1·8.
D. Genitalia. × 1·8.
E. Jaw, × 9, and teeth of radula, × 270.]

last rounded at the periphery, moderately convex beneath, impressed in the middle; aperture slightly oblique, broadly lunate, thinly labiate and white inside; peristome sharp, the basal margin arcuate, columellar oblique, briefly reflexed above.

Major diam. 22½, min. 20, height 11 mm. A large specimen from Manipur measures 28 by 23·5 mm.

Hab. North Cachar Hills, higher parts; Burrail Range, Naga Hills; Manipur Hills; Toruputu Peak, Dafla Hills; Khakhyen

(Kachin) Hills, Upper Burma. Nevill (*l. c.*) adds Cachar, Tezpur, Assam, Teria and Borpani, but these are very doubtful.

Animal black throughout. Right shell-lobe well developed, left shell-lobe overlapping the edge of the peristome, but wanting the tongue-shaped process of *M. indica*. Left dorsal lobe in two portions, right simple. Generative organs as in *M. indica*; spermatheca very long, kalc-sac rounded. Teeth of radula 35 . 3 . 15 . 1 . 15 . 3 . 35 (53 . 1 . 53). Similar in form to those of *M. indica*, but the broad inner laterals or admedians more numerous, there being altogether 31 broad teeth in the middle instead of 19.

In typical shells there is no sculpture, but some small specimens referred to this species are longitudinally striated. The identification is not certain. Nevill classed this species as a variety of *resplendens*, which is a much thinner shell, devoid of labiation.

[There is also considerable difference in the shell-lobes, and particularly in the generative organs, and *resplendens* has been placed in another genus.]

145. **Macrochlamys castaneo-labiata**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 119, pl. 29, figs. 1–7 (shell, 3 vars., and anatomy).
[*Vide* fig. 45 B, p. 105.]

Shell perforate, subconoidly depressed, rather solid, regularly minutely and lirately sculptured longitudinally under a lens, light brown to pale ochraceous horny; spire low conoid, suture impressed; whorls 6, convex, the last broader, rounded at the periphery, slightly swollen beneath; aperture subvertical, broadly lunate; peristome thin, strongly labiate inside, often some distance within the lip, columellar margin oblique, briefly expanded and rather broadly reflected above, covering the perforation in part.

Major diam. 15½, min. 14½, height 7½ mm. A smaller specimen measures 13½ × 12 × 7. Specimens from Manipur Hills measure 18½ × 15½.

Hab. Burrail Range, Assam. Asalu, Hengdan and Japvo Peaks; Naga and Manipur Hills (*Godwin-Austen*).

In the animal the shell-lobes are very long and some portions of the anatomy are peculiar. The *vas deferens* leads to a blunt swollen tube representing the kalc-sac, and this leads to a thick cæcum, to the side of which the retractor muscle of the penis is attached. The cæcum is not coiled as in typical forms of *Macrochlamys*. The amatorial organ is large and terminates in a blunt rounded end. The spermatheca is long and the free end broader and ovate as usual.

The radula contains about 82 transverse rows of teeth, thus arranged: 45 . 2 . 8 . 1 . 8 . 2 . 45 (55 . 1 . 55). The 17 teeth in the middle are tricuspid and much broader than the others; the outer laterals are simple elongate teeth, more like those of *Ariophanta* or *Oxytes*. The jaw also is far straighter than usual.

146. **Macrochlamys hepatizon**, *Godwin-Austen, Mol. Ind.* i, 1888, p. 209, pl. 53, figs. 3, 4 (shell).

Shell perforate, depressed, discoidal, solid, smooth, faintly striated transversely, slightly polished, yellowish brown; spire flat, suture moderately impressed; whorls 5, rather closely wound, the last rounded at the periphery, flatly convex beneath; aperture oblique, lunate; peristome thickened within on basal margin, which is arcuate, columellar margin sinuate, vertical for a short distance above and broadly reflected.

Major diam. 14, min. 12¾, height 5 mm.

Hab. Hills north and south of Assam Valley; Toruputu Peak, Dafla Hills; Habiang Gáro Hills (*Godwin-Austen*).

This form closely resembles *M.* ? *consepta* from Burma, but the whorls are fewer, the size smaller, and the colour different.

147. **Macrochlamys lata**, *Godwin-Austen, Mol. Ind.* i, 1888, p. 209, pl. 53, fig. 8.

Similar to *M. hepatizon*, but smaller, milky-white or grey in colour; the spire slightly higher and the aperture more oblique, with its upper margin sloping outwards and downwards, not horizontal.

Major diam. 9, min. 8·5, height 3·4 mm.

Hab. Teria Ghat, Khasi Hills (*Godwin-Austen*).

b. *Not labiate.*

148. **Macrochlamys decussata**, *Bs.* (Nanina) *J. A. S. B.* v, 1836, p. 330; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 70; *id. t. c.* iii, 1853, p. 62; *H. & T.* (Helix) *C. I.* 1876, pl. 112, figs. 1, 2, 3; *Godwin-Austen, Mol. Ind.* i, 1883, pl. 19, fig. 6 (animals in coitû), pl. 21, fig. 15 (shell-sculpture) (1883).

Shell perforate, depressed, thin, smooth and silky above, polished beneath, under the microscope decussated above with slightly flexuous transverse striæ and fine impressed lirate longitudinal lines, radiately and concentrically striated below, fulvous horny; spire but little raised, suture slightly impressed; whorls 6-7, slightly convex, regularly increasing, the last subangulate at the periphery in small specimens, rounded in larger shells, base moderately swollen; aperture slightly oblique, lunate; peristome thin, simple, upper margin nearly straight, basal subarcuate, columellar inclined, briefly reflexed at the perforation.

Major diam. 31, min. 27, height 13 mm.

Hab. Khási Hills, common at Cherra Punji.

The type, measuring 25 mm. in major diameter, was subangulate at the periphery and possibly immature.

[The animal has a very long right shell-lobe which can be extended to the apex of the shell, the left is far shorter.]

149. **Macrochlamys lhotaensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 107, pl. 23, fig. 5 (shell); *id. t. c.* ii, 1897, p. 49.
Macrochlamys marshalli, *Tryon, Man. Conch.* pt. 2, 1886, p. 101.

Shell very much like that of *M. decussata*, but having a broader last whorl and different sculpture. The longitudinal (concentric) striation on the whorls above and below is much stronger than the transverse and looks almost costulate under a microscope. Subumbilicate, depressed, thin, dark brownish horny; spire low, suture scarcely impressed; whorls 7, flatly convex, the last rounded at the periphery, flattened below; aperture broadly lunate, subovate, columellar margin oblique, scarcely reflected.

Major diam. 23, min. 20, height 10½ mm.

Hab. Lhota Naga Hills (*Godwin-Austen*).

I have only seen one specimen of this shell, the type, which is immature.

150. **Macrochlamys rubellocincta**, *Blf.* (Nanina) *J. A. S. B.* 1870, 2, p. 14, pl. 3, fig. 9; *H. & T.* (Helix) *C. I.* 1876, pl. 51, figs. 5, 6; *Pfr. Mon. Hel.* vii, 1876, p. 121.

Shell perforate, depressed, thin, smooth, somewhat polished above, more so beneath, finely decussated above with microscopical transverse slightly flexuous striæ and fine longitudinal impressed lines, the latter wanting below; inner half of each whorl whitish horny, outer half rufous, the latter colour forming a broad belt round the periphery; spire almost flat, suture very shallow; whorls 6–6½, slightly convex above, the last subangulate at the periphery, moderately swollen below; aperture slightly oblique, broadly lunate; peristome thin, basal margin subarcuate, columellar inclined, reflected briefly above.

Major diam. 35, min. 31, height 14 mm. A smaller specimen measures 31 by 28 by 12 mm.

Hab. Habiang Gáro Hills (*Godwin-Austen*). [This shell has only been found on the Nummulitic limestone south of the Yindku Peak; the animal was not seen.]

This is near *decussata*, but is distinguished by being much flatter above and by its very different coloration and sculpture.

151. **Macrochlamys bilineata**, *Godwin-Austen, J. A. S. B.* 1876, 2, p. 311 pl. 8, fig. 9.

Shell imperforate, subglobosely depressed, very thin, transparent, polished, brownish horny, beneath the microscope very minutely and closely longitudinally striated, the striation not easily seen; spire low, suture impressed; whorls 5, convex, the last well rounded at the periphery and beneath; aperture oblique, roundly lunate; peristome thin, slightly arcuate above and at the base, columellar margin curved, vertical above, slightly reflected.

Major diam. 12, min. 10, height 6 mm.

Hab. Tanir Lampa ridge, 4000′; Dafla Hills, north of Assam. Abundant in forest amongst fallen leaves (*Godwin-Austen*).

The animal is described as "pale ochraceous; tentacles black, the black extending on to the neck as two very conspicuous well-defined parallel lines; the upper part of the foot has also two parallel black lines. From the right anterior margin a long tongue-like process is given off which reaches, when partly extended, up to the apex of the shell."

152. **Macrochlamys uda**, *Godwin-Austen, Mol. Ind.* ii, 1899, pp. 133, 136, pl. 94, fig. 1 (spermatophore).

Shell subperforate, depressed to conoidly depressed, smooth, polished, very finely and closely striated spirally (longitudinally) throughout under the microscope, pale umber-brown; spire very low, convexly conoid, suture impressed; whorls 6, convex, slowly increasing, the last rather broader, descending slightly towards the mouth, rounded at the periphery, convex beneath; aperture oblique, lunate; peristome slightly obtuse in adults, basal margin arcuate, columellar oblique, nearly straight, slightly expanded throughout, scarcely more so at the junction with the last whorl.

Major diam. 8½, min. 7½, height 4½ mm.

Hab. Hills on both sides of Assam Valley. Found by Godwin-Austen at Toruputu Peak, Dafla Hills, and at the southern base of the range; also in the Gáro, Khási, and Nága Hills, and in Manipur.

Shells from different localities vary in size, the largest exceeding 10 mm. in diameter, and in the height of the spire. The species may be recognized by its almost or completely closed perforation and arcuate basal margin of the peristome, also by the slight descent of the last whorl in adults.

Macrochlamys shengorensis, *Godwin-Austen, Mol. Ind.* i, 1883, p. 102, pl. 22, fig. 5; ii, 1907, p. 185.

Shell perforate, depressed, brownish tawny, thin, polished, with fine, rather close, microscopic lirate longitudinal striation throughout above and below; spire almost flat, suture scarcely impressed; whorls 4½ (immature), flat above, the last considerably broader, rounded at periphery, flatly convex beneath; aperture nearly vertical, broadly lunate; peristome thin, columellar margin curved, oblique, reflected above, partly covering perforation.

Major diam. 11, min. 10, height 5 mm.

Hab. Shengor Peak, Dafla Hills (*Godwin-Austen*).

Only immature shells are known. These are distinguished by flatness and by the lirate concentric sculpture.

[This has proved to be the young of *Staffordia daflaensis*.]

153. **Macrochlamys cacharica**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 177, pl. 27, fig. 2 (shell and anatomy).

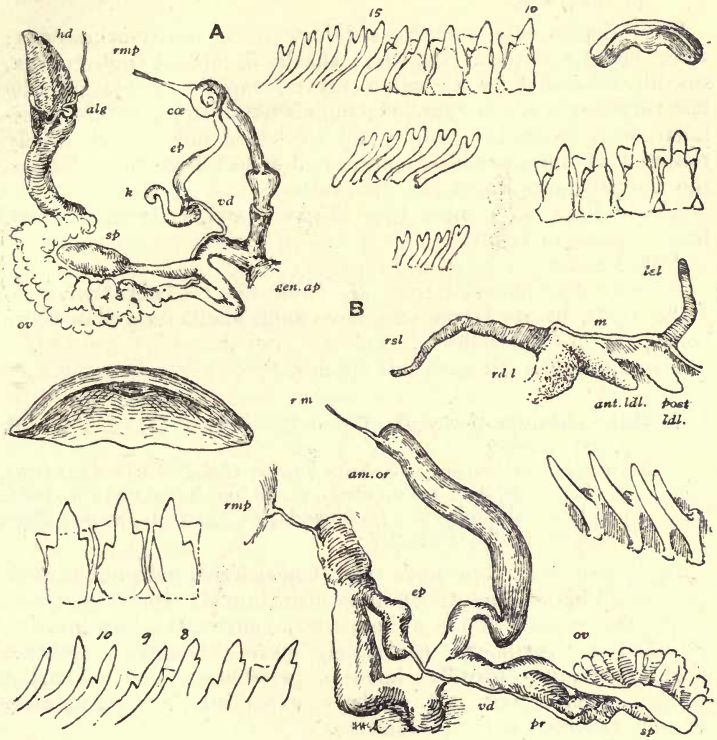
[Fig. 45 A, p. 105.]

Shell openly perforate, depressed, thin, glassy, smooth, brownish

tawny; spire very low, conoidal, suture slightly impressed; whorls 6, regularly increasing, convex above, the last scarcely broader, rounded at the periphery, flatly convex beneath; aperture slightly oblique, broadly lunate; peristome thin, basal margin slightly arcuate, columellar oblique, reflected above.

Major diam. 19, min. 17½, height 8 mm.

Hab. Manipur Hills (*Godwin-Austen*).



[Fig. 45.—*Macrochlamys cacharica.*

A. Generative organs, × 3; jaw, × 9; and teeth of radula, × 270.

Macrochlamys castaneo-labiata.

B. Shell and dorsal lobes, × 3, separated from the animal; jaw, × 9; radula, × 255; and genitalia, × 3.]

Var. *glauca*, paler in colour and larger, last whorl slightly broader.

Major diam. 22½, min. 19½, height 10 mm.

Hab. Harmutti, base of Dafla Hills, Assam (*Godwin-Austen*).

This shell is very similar to *M. atricolor*. It is paler in colour and larger, the last whorl is rather larger and the base is flatter

and there is no trace of labiation inside the aperture. The anatomy differs considerably. *There is no dart-sac*; the kalc-sac of the penis is much longer and the spermatheca short and club-shaped, with the terminal portion ovate. The teeth on the radula are arranged thus: 38 . 2 . 12 . 1 . 12 . 2 . 38 (52 . 1 . 52) and rather peculiar in shape.

*154. **Macrochlamys salmonea**, *Ancey* (Nanina-Medyla), *Le Nat.* ii, p. 119 (1882).

Shell depressedly convex, shining, thin, horny-ochraceous; spire broadly conical, obtuse; whorls 5, almost not convex, smooth, separated by a shallow suture, rapidly increasing, the last very large, much rounded; umbilicus small; aperture semilunar, scarcely oblique, simple, not thickened nor sinuate, briefly reflected at the columellar margin and deflected at the umbilicus, the margins united by a very thin callus.

Major diam. 12½, min. 10½, height 8 mm.; aperture 7 mm. broad (*Ancey* in Latin).

Hab. Cachar.

"Easily distinguished from *H. bilineatus*, Godwin-Austen, of Dafla Hills, by its larger size, more solid shell, its yellow-ochre colour, and its less globose form."

I am unacquainted with this species.

155. **Macrochlamys godwini**, *Tryon, Man. Conch.* ser. 2, Pulm. ii, p. 101 (1886).

Macrochlamys koliaensis, *Godwin-Austen, Mol. Ind.* i, October 1883, p. 119, pl. 26, figs. 5–5 *a* (shell), pl. 28, fig. 3 (radula); ii, 1898, p. 50: *nec* M. koliaensis, *Godwin-Austen, op. cit.* i, January 1883, p. 86, pl. 17, fig. 6 (shell).

Shell perforate, depressed, thin, transparent, polished, smooth (no longitudinal sculpture), brownish horny; spire very low, suture impressed; whorls 5 (immature), convex, the last broader, rounded at periphery, moderately convex beneath; aperture slightly oblique, broadly lunate; peristome thin, columellar margin much curved, vertical above, expanded throughout, more broadly reflected at the perforation.

Major diam. 12, min. 10½, height 5½ mm.

Hab. Koliaghur on Brahmaputra River, Nowgong District, Assam (*Godwin-Austen*).

The animal is "dusky green; side of foot grey, spotted with sienna; extremity of foot with gland, having an overhanging lobe long and pointed." Teeth of radula in 93 rows, thus arranged: 42 . 2 . 10 . 1 . 10 . 2 . 42 (54 . 1 . 54).

156. **Macrochlamys terminus**, *Godwin-Austen, Mol. Ind.* ii, 1899, pp. 134, 136, pl. 94, figs. 3, 3 *a* (spermatophore).

Shell perforate, depressed, thin, smooth, polished; spire very low, convexly conoidal, apex obtuse, suture scarcely impressed, shallow; whorls 6, flatly convex above, the last broader, rounded

at the periphery, convex beneath; aperture subvertical, broadly and ovately lunate, margins converging; peristome thin, the basal margin slightly arcuate, columellar margin vertical for a short distance above, and reflected, then curved and oblique, slightly expanded.

Major diam. 12½, min. 11½, height 6 mm.

Hab. Brahmakund, Eastern Assam; Singpho (*M. Ogle*); Naga and N. Cachar Hills (*Godwin-Austen*).

a'. *Shell globose.*

b'. *Strongly or microscopically striate longitudinally.*

[157. **Macrochlamys beata**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 156, pl. 108, figs. 1–1 *b*.

Shell depressedly globose, rather thin, imperforate; sculpture wavy, strong, regular longitudinal striation, crossed by distant lines of growth; colour olivaceous brown; spire low, apex rounded; suture shallow; whorls 5, gradually expanding; aperture ovate, oblique; peristome thin; columellar margin oblique, with a very slight reflection.

Size: maj. diam. 12·0, alt. axis 4·5 mm.

Locality. Shengorh Peak, Dafla Hills, 6000 ft. (*Godwin-Austen*).

Among specimens of this shell, I noticed one which contained a dried-up animal in good preservation. It was put to soak, and after 15 days was examined, when the external characters were remarkably well seen, even to the peripodial grooves and streaks on side of the foot. It has a narrow tongue-like right shell-lobe and a similar well-developed left shell-lobe. After further soaking in water for 24 days, the amatorial organ was well seen and the jaw secured; the radula was broken up, but after a long search over three glass slides which had been in use I found and mounted a portion of it. The central teeth have a cusp on the outer side and a small one on the inner apical margin. The admedian are all short and straight-sided, not bicuspid, an unusual character.

The shell-lobes are like those of *Macrochlamys*, and I place it in that genus.]

[158. **Macrochlamys munipurensis**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 158.

Shell very globose and conoid, thin, scarcely and finely perforate; sculpture smooth and glassy to the eye, yet under high power and in good light extremely fine fairly regular striation is visible; colour pale straw with a green tinge; spire high, conic; suture impressed; whorls 4½, the last expanding rapidly, well rounded on the periphery; aperture roundly lunate, subvertical; peristome thin; columella very weak, scarcely any reflection, margin sub-oblique.

Size: maj. diam. 11·5, alt. axis 6·5 mm.

Locality. N.E. Munipur Hills (*Godwin-Austen*). Two specimens in Brit. Mus. Nat. History collection.]

[159. **Macrochlamys fragosus**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 161, pl. 109, fig. 4.

Shell scarcely perforate, globose, thin, translucent; sculpture fine microscopical regular longitudinal striæ; colour sap-green; spire flatly convex; suture shallow; whorls $3\frac{1}{2}$, last swollen and rounded at the periphery; aperture semi-ovate; columellar margin perpendicular, not reflected, weak.

Size: maj. diam. 6·7, min. 6·0; alt. axis 3·5, alt. body-whorl 2·8 min.

Locality. Toruputu Peak, Dafla Hills (*Godwin-Austen*).

The shell figured has been considerably damaged, but fortunately two other specimens should be preserved in the Calcutta Museum.

Vide Nevill's Hand-list, no. 167, p. 39. 3, from above locality.]

a''. *Shells depressedly conoid.*

b''. *Sculpture smooth.*

[160. **Macrochlamys mahadeoensis**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 157, pl. 108, figs. 3–3 *b*.

Shell depressedly globose, thin, not umbilicated; sculpture smooth, crossed by irregular lines of growth; colour dull olivaceous green; spire flatly conoid; suture impressed; whorls 4, the last expanding and capacious, rounded on the periphery; aperture flatly ovate, subvertical; peristome thin; columellar margin sub-oblique.

Size: maj. diam. 11·5, min. 9·5, alt. axis 5·0 mm.

Locality. Mahadeo Peak, Burrail Range, near Asalu (*Godwin-Austen*).

Shell-lobes, from what was left of them, resemble those of typical *Macrochlamys*, tongue-like.

Jaw not found.

Radula formula:

$$\begin{matrix} 43 \,.\, 2 \,.\, 10 \,.\, 1 \,.\, 10 \,.\, 2 \,.\, 43 \\ 55 \,.\, 1 \,.\, 55 \end{matrix}$$

The centre tooth is tricuspid; the admedian teeth have a small cusp on the inner side just below the main point, with another basal cusp on the outside; the lateral teeth are evenly bicuspid, the marginals small.

In this species the odontophore is of the same type as that of *Austenia gigas*, with the inner upper cusp on the admedian teeth.]

[161. **Macrochlamys hengdanensis**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 158, pl. 108, figs. 4–4 *b*.

Shell globosely conoid, very thin, transparent, somewhat glassy, umbilicated, extremely minute and hidden; sculpture, surface quite smooth; colour pale sap-green; spire subconical, apex

elevated, blunt; suture shallow; whorls 4½; aperture suboblique, nearly circular; peristome very thin; columellar margin subvertical.

Size: maj. diam. 10·4, alt. axis 5·0 mm.

Locality. Hengdan Peak, North Cachar Hills (*Godwin-Austen*).

Animal not seen.]

[162. **Macrochlamys razamiensis**, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 157, pl. 108, figs. 2–2 *b*.

Shell globose; umbilicus concealed, very thin and transparent, glassy; sculpture none; colour pale sap-green; spire subconoid; suture shallow; whorls 5, very convex and rounded on the periphery; aperture ovate, nearly vertical; peristome very thin; columellar margin oblique.

Size: maj. diam. 10·25, alt. axis 4·75 mm.

Locality. Kopamedza Peak, Naga Hills (*Godwin-Austen*).

Animal. Shell-lobes present, but not well preserved in the soaked specimen. Foot moderately large, gland seen; olivaceous in colour; sole divided.

Animal dark-coloured, the shell-lobes still darker.

Jaw with a central projection.

Radula has a formula:

$$\begin{matrix} 39 \cdot 2 \cdot 10 \cdot 1 \cdot 10 \cdot 2 \cdot 39 \\ 51 \cdot 1 \cdot 51 \end{matrix}$$

Centre tooth bicuspid; admedian teeth bicuspid; laterals bicuspid, becoming rapidly minute on the margin.]

[163. **Macrochlamys lahupaensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 159.

Shell subdepressedly conoid, rounded below, thin, perforation fine, nearly concealed; sculpture none under high power, crossed by many fine wavy lines of growth under eye; colour pale ashy ochre; spire subconic, sides flat, apex fine; suture impressed; whorls 5½, closely wound, particularly near the apex; aperture widely horizontally lunate, subvertical; peristome both slightly thickened and sinuate; columellar margin oblique and very slightly reflected near the umbilicus.

Size: maj. diam. 13·0, min. 11·0; alt. axis 6 mm.

Locality. Phunggam, Lahupa-Naga Hills, N.E. Munipur (*Godwin-Austen*).]

[164. **Macrochlamys hookeri**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 163, pl. 109, figs. 10–10 *a*.

Shell scarcely perforate, tumidly globose, thin, diaphanous, smooth, strong epidermis; colour dull ochraceous; spire depressedly conoid; whorls 4, slightly convex above, rather rapidly increasing; aperture suboblique, ovoid; peristome nearly circular on the periphery; columellar margin straight, perpendicular, weak.

Size: maj. diam. 10·0, min. 8·2; alt. axis 4·0 mm.

Locality. Cherra Poonjee and in the valley to the eastward.

This shell was also found at Jawai, in the Jaintia Hills. I have named it after Sir Joseph Hooker, who describes so well in his 'Himalayan Journals' the deep valley under Cherra Poonjee.]

c. *Upper surface transversely plicate or ribbed.*

165. **Macrochlamys ? plicifera**, *Blf. J. A. S. B.* 1880, 2, p. 197.
Nanina plicatula, *Blf. J. A. S. B.* 1870, 2, p. 13, pl. 3, fig. 7; *Godwin-Austen, J. A. S. B.* 1875, 2, p. 2; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 126; *H. & T.* (Helix) *C. I.* 1876, pl. 28, fig. 1: *nec* N. plicatula, *Martens, Nach. d. Mal. Ges.* 1869, p. 149.

Shell subobtectly perforate, depressed, almost lenticular, thin, translucent, yellowish horny, with dull waxy lustre, concentrically and subpapillosely striated above and below, plicate near the periphery; spire low, conoidal, suture very slightly impressed; whorls $5\frac{1}{2}$, almost flat above, the last much broader, angulate and nodosely plicate at the periphery, swollen truncate, the plications

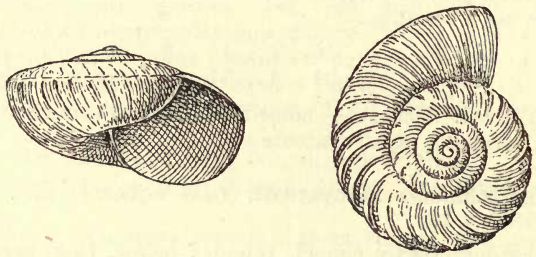


Fig. 46.—*Macrochlamys plicifera.*

oblique and gradually disappearing on both upper and lower surface away from the outer edge; aperture oblique, roundly lunate; peristome thin, basal margin arcuate, columellar curved, vertical and reflected above.

Major diam. $22\frac{1}{2}$, min. $19\frac{1}{2}$, height 10 mm.

Hab. Satunga, N. Cachar Hills, on limestone rocks (*Godwin-Austen*).

[Animal pale brown, mottled very evenly with umber over the head and sides, a distinct line of darker colour down the centre of the back; moderately long gland at extremity of foot, which is rather truncate. Two parallel lines run from mantle to the oral tentacles, about $1\frac{1}{4}$ inch in length.

I obtained a large number of this species alive; no reference is made to the presence of shell-lobes in my note-book, in which there is, besides, a pencil sketch of the animal's head as far back as the dorsal lobe. It is therefore very doubtful if it should be placed in this genus.]

166. **Macrochlamys shisha**, *Godwin-Austen* (Helix-Nanina), *J. A. S. B.* 1875, 2, p. 2, pl. 1, fig. 3; *Pfr.* (Helix) *Mon. Hel.* viii, 1877, p. 559.

Shell obtectly perforate, lenticular, sharply keeled, very thin and fragile, almost membranaceous beneath, translucent, transversely and rather obliquely plicate above, smooth beneath, without longitudinal sculpture; spire low conoidal, suture but little impressed; whorls 5, slightly convex above, the last considerably broader; sharply and compressedly keeled; convex beneath; aperture slightly oblique, angulately lunate; peristome thin.

Major diam. 14½, min. 12½, height 7 mm.

Hab. North Khasi Hills, Moyong, Dikrang, 2000′; Naga Hills, Nenglo, in damp forest (*Godwin-Austen*).

All the specimens are imperfect beneath, but the types are probably adult or nearly so. Animal not observed.

d. *Shells not exceeding about* 6 *mm.* (*a quarter inch*) *in diameter.* (Generic affinities often doubtful.)

a. *Subglobose or subturbinate.*

a′. *Smooth.*

167. **Macrochlamys nengloensis**, *Godwin-Austen*, *Mol. Ind.* i, 1883, p. 86, pl. 17, figs. 3, 5.

Shell subobtectly perforate, depressedly turbinate, smooth, without sculpture, faintly polished brownish yellow with an olivaceous tinge; spire conoidal, apex blunt, suture impressed; whorls 5½, convex, rather closely wound, the last subangulate at the periphery, tumid beneath; aperture oblique, lunate; peristome thin, columellar margin broadly reflected, oblique, almost vertical above.

Major diam. 5, min. 4·5, height 3·5 mm.

Hab. Nenglo, Nága Hills, and Manipur (*Godwin-Austen*).

This appears to be a variety of *M. longicauda*.

168. **Macrochlamys koliaensis**, *Godwin-Austen*, *Mol. Ind.* i, 1883, p. 86, pl. 17, fig. 6 (shell), *nec* p. 119.

Shell imperforate, depressedly turbinate, thin, smooth, not highly polished above, more so below, without sculpture, light yellowish brown; spire conoidal, suture impressed; whorls 6, convex, closely wound, the last scarcely larger, rounded at periphery, moderately swollen beneath; aperture subvertical, lunate; peristome thin, columellar margin oblique, reflected.

Major diam. 4·5, min. 4, height 2·5 mm.

Hab. Koliaghur, Nowgong district, Assam, on low hills near the Brahmaputra River (*Godwin-Austen*).

This species is rather more closely wound than *M. nengloensis*, and the last whorl is rounded, not subangulate.

169. **Macrochlamys roberti**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 87, pl. 17, fig. 17.

Shell minutely perforate, depressedly turbinate, thin, smooth, scarcely polished above, more so below, minutely striated transversely, without spiral (longitudinal) sculpture, brownish horny; spire conoidal, apex obtuse, suture impressed; whorls 6, convex, rather closely wound, the last rounded at the periphery, tumid below; aperture subvertical, lunate; margins converging; peristome thin, columellar margin oblique, curved, almost vertical above, rather broadly triangularly reflected.

Major diam. 4, min. 3·75, height 2·5 mm.

Hab. Angauluo Peak, 6777′; Burrail Range, Nága Hills (*Godwin-Austen*).

This is distinguished from *M. koliaensis* by its lower spire and by being perforate.

170. **Macrochlamys tanirensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 87, pl. 17, fig. 9.

Shell obtectly perforate, subglobosely depressed, thin, polished, smooth, light yellowish brown; spire low, convexly conoid, apex obtuse, suture impressed; whorls 4½, convex, increasing slowly, the last rounded at the periphery, swollen below; aperture nearly vertical, lunate; peristome thin, columellar margin oblique, rather broadly reflected.

Diam. 2·8, height 1·75 mm.

Hab. Tanir Peak, Dafla Hills, 4400′ (*Godwin-Austen*).

b′. *Longitudinally striated.*

171. **Macrochlamys longicauda**, *Godwin-Austen, Mol. Ind.* i, 1883, pp. 84, 85, pl. 17, figs. 1, 2, 2*a*, 4 (shells), pl. 20, figs. 1 *a–e* (animal and radula), pl. 21, fig. 16 (sculpture).

Shell subobtectly perforate, depressedly turbinate, pale horny brown to yellowish tawny, not polished above, and under the microscope marked with two series of very fine oblique striæ at right angles to each other (these appear to be wanting in some varieties), smooth and polished below; spire low, conical, apex obtuse, suture impressed; whorls 5½, regularly increasing, convex above, the last angulate at the periphery, tumid beneath; aperture slightly oblique, angulately lunate; peristome thin, columellar margin much curved, expanded throughout, vertical and sharply reflected at perforation.

Major diam. 6, min. 5·6, height 4 mm.; smaller specimens measure 4 to 5 mm. in diameter.

Hab. Khási, Jaintia, and North Cachar Hills; Cherra Punji, Maotherichan Peak, Jawai, Marangsip Peak, &c.

Caudal extremity of foot abruptly truncated, lobe above large, mucous pore greatly developed. Colour pale, with a dark grey line

on upper surface to extremity of foot. Shell-lobes present, the right tongue-shaped. Jaw without median projection. Outer teeth in radula numerous and bicuspid, nearly twice as numerous as in *M. indica*, the formula being 76 to 80 . 3 . 5 . 1 . 5 . 3 . 76 to 80 (84 . 1 . 84). Middle tooth tricuspid, long, with convex sides, the next 5 long and bicuspid, having a lateral cusp on the outer side only.

172. **Macrochlamys dorani**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 87, pl. 17, fig. 8.

Shell obtectly perforate, globosely subturbinate, thin, regularly minutely subdistantly longitudinally striated beneath the microscope above and below, light yellowish brown; spire conoidal, apex obtuse, suture impressed; whorls 5, convex, the last rather larger, rounded at periphery and below; aperture subvertical, lunate; peristome thin, columellar margin almost vertical above, triangularly reflected, the edge projecting slightly convexly above the perforation.

Diam. 3·25, height 2 mm.

Hab. Maotherichan Peak, N. Khási Hills (*Godwin-Austen*).

This is near *M. umbraticola*, but has a higher spire, more closely wound whorls, and a different colour. The microscopic sculpture is less close.

The slight projection in the columellar margin above the perforation may indicate that this is a *Microcystina*.

173. **Macrochlamys originaria**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 91, pl. 14, fig. 12 (shell).

Shell perforate, turbinately depressed, smooth, with fine longitudinal striation, sienna-brown; spire conoidal, sides convex, apex obtuse, suture impressed; whorls 4½, convex, the last slightly subangulate at the periphery, tumid beneath; aperture subvertical, ovately lunate; peristome thin, columellar margin oblique, broadly reflected above.

Major diam. 2, height about 1·5 mm.

Hab. Shenghor and Toruputu Peaks, Dafla Hills, north of Assam (*Godwin-Austen*).

174. **Macrochlamys umbraticola**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 89, pl. 14, figs. 4 (shell), 4 *a* (sculpture).

Shell obtectly perforate, globosely subturbinate, pale olivaceous brown, very minutely regularly spirally (longitudinally) striated beneath the microscope above and below; spire convexly conoid, apex obtuse, suture impressed; whorls 4½, convex, the last not descending, rounded at the periphery and beneath; aperture slightly oblique, roundly lunate; peristome obtuse, in one plane, columellar margin nearly vertical, carried forward and slightly reflected, almost or quite covering the perforation.

Major diam. 3–5, min. 3, height 2 mm.

Hab. Hengdan Peak, North Cachar Hills; Jatinga Valley and Kopamedza Peak (8376′), Naga Hills.

The type measured 4·3 mm. in major diameter.

a′. *Depressed or conoidly depressed.*

b″. *Longitudinally striated.*

175. **Macrochlamys? sata**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 91, pl. 14, fig. 13.

Shell imperforate, depressed, thin, polished, very finely longitudinally (spirally) striated under the microscope, pale brownish horny; spire very low, apex obtuse, suture impressed; whorls $4\frac{1}{2}$, convex, the last rounded at the periphery, convex beneath; aperture nearly vertical, roundly lunate; peristome thin, columellar margin oblique.

Diam. 2, height scarcely 1 mm.

Hab. Shenghor Peak (6706′) and Toruputu Peak (7322′), Dafla Hills in Eastern Himalayas, north of Assam; one specimen from each locality.

176. **Macrochlamys pacata**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 90, pl. 14, fig. 10.

Shell obtectly perforate, almost imperforate, depressed, thin, smooth, moderately polished, under the microscope subdistantly longitudinally (spirally) striated above and below; spire very low, apex obtuse, suture impressed; whorls $4\frac{1}{2}$, convex, the last rounded at the periphery, somewhat swollen beneath; aperture subovately lunate, slightly oblique; peristome thin, columellar margin much curved, vertical and reflected above, almost covering the perforation.

Major diam. 3, min. $2\frac{1}{2}$, height $1\frac{1}{2}$ mm.

Hab. Lhota Naga Hills.

The type, apparently the only specimen known, is not fully grown.

177. **Macrochlamys rusticula**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 87, pl. 17, fig. 10.

Shell obtectly perforate, conoidly depressed, thin, smooth, not polished above, translucent, pale brown; spire low, conoidal, suture impressed; whorls 4, convex, the last rather broader, rounded at the periphery, flatly convex beneath; aperture subovately lunate; peristome thin, columellar margin oblique.

Diam. 2·1, height 1 mm.

Hab. North Khasi Hills.

The only specimen is probably immature. There is an indistinct appearance resembling sculpture under the microscope, but no striation can be made out.

E. Species from Burma, Arakan, and Tenasserim.

a. *Peristome labiate.*

178. **Macrochlamys? consepta**, *Bs.* (Helix) *A. M. N. H.* (3) vi, 1860, p. 190; xi, 1863, p. 320; *Pfr.* (Helix) *Mon. Hel.* v. 1868, p. 239; *H. & T.* (Helix) *C. I.* 1876, pl. 88, figs. 5, 6; *Godwin-Austen, Mol. Ind.* i, 1888, p. 209, pl. 53, fig. 1; *id.* 1883, p. 110, pl. 26, fig. 4 (small var., more globose); *id. P. Z. S.* 1888, p. 241 (small var.).

Shell subperforate, depressed, almost discoidal, not thin, smooth, polished, glassy, whitish horny; spire almost flat, apex slightly raised, suture impressed; whorls 7, convex, closely wound, the last not much broader, rounded at the periphery, slightly convex beneath, impressed in the umbilical region; aperture almost

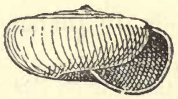


Fig. 47.—*Macrochlamys (?) consepta.*

vertical, broadly lunate; peristome blunt, white and narrowly labiate within, basal margin slightly arcuate, columellar oblique, expanded and reflected above, almost completely closing the perforation.

Major diam. 18, min. 16, height 7 mm.

Hab. Damathat near Moulmein, Muleyit Range (4000′); Upper Burmah; Shan States?

Benson described the type as obsoletely spirally striated, but no sculpture can be detected on numerous specimens examined. Easily recognized by its almost flat whitish glassy shell. The animal is not known and the generic relations are doubtful.

a′. *Smooth.*

179. **Macrochlamys? petasus**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 388; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 197; *H. & T.* (Helix) *C. I.* 1876, pl. 89, figs. 8, 9; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 35; *Godwin-Austen, Mol. Ind.* i, 1883, p. 210, pl. 53, fig. 6 (shell).

Shell subobtectly perforate, depressed, smooth, polished, yellowish tawny; spire low, convexly conoid, suture scarcely impressed; whorls 5–6, increasing slowly, flatly convex above, the last rounded to slightly subangulate at the periphery, convex beneath; aperture subvertical, broadly lunate; peristome blunt, very narrowly labiate inside at the edge, basal margin slightly arcuate, columellar oblique, rather broadly reflected above.

Major diam. 10½, min. 9½, height 5 mm.

Hab. Phiethan, Tenasserim Valley. I wrongly regarded as identical a snail common about Thayetmyo in Pegu and in the Arakan Hills, now distinguished as *M. notha*. Nevill refers to

this species shells from Arakan, the Assam Hills, and near Darjiling, but the identification requires further comparison.

[*Vide* p. 35, Nevill's 'Hand-list':—

Only the shells from Phiethan belong to this species.

I have gone through most of the shells referred to *petasus* from localities in the Assam Hills and Darjiling, sent home to me by Mr. G. Nevill; they all belong to different species; those recorded from Toruputu, Borpani, Tanir Peak, and Dikrang are *M. uda*, Godwin-Austen.

Same page, "Var. (? distinct species)":—

From places in the Dafla Hills belong to a form yet to be described.

Same page, "Var. (? distinct species)":—

12 Arakan are *subpetasus*, Godwin-Austen.

Page 36:—

2 Borpani, 3 Khasi Hills, 10 Dikrang are *hepatizon*, Godwin-Austen, var.

3 Needoungtoung=*subpetasus*, G.-A.]

180. **Macrochlamys? aspides**, *Bs.* (Helix) *A. M. N. H.* (3) xi, 1863, p. 320; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 197; *H. & T.* (Helix) *C. I.* 1876, pl. 62, figs. 7, 8, 9; *Theob. Cat.* 1876, p. 17.

"Shell obtectly perforate, orbiculately depressed, scarcely striated, smooth, polished, horny, subdiaphanous; spire somewhat convex, flattish, apex slightly raised; suture faintly impressed, submarginate; whorls 6, very slightly convex, slowly increasing, the last finally broader; aperture oblique, broadly lunate; peristome briefly lying open (very slightly expanded), thickened and white inside, broader below, upper margin prominent and much arcuate; basal margin arcuately bisinuate, columellar very short, slightly reflected above, its border narrowly callous." (*Bs.*, Latin.)

Major diam. 11, min. 9, axis 5 mm.

Hab. Tenasserim (*Theobald*).

Distinguished by the strongly arcuate and thickened basal margin of the peristome.

b. *Peristome not labiate.*

181. **Macrochlamys chaos**, *Blf. P. Z. S.* 1904, ii, p. 444, pl. 25, fig. 8.

Shell perforate, conoidly depressed (subglobose), thin, smooth, transversely striated, and with microscopic, very fine, close, flexuous, longitudinal (spiral) sculpture, vitreous, pale fulvous or whitish horny; spire low, apex acute, suture impressed; whorls $5\frac{1}{2}$, slightly convex, the last broader, rounded externally, convex beneath; aperture oblique, roundly lunate, the breadth exceeding the height; peristome very thin, in one plane, columellar margin curved, vertical above and briefly triangularly reflected.

Major diam. 16, min. 14, height 8 mm. A small specimen measures $13 \times 12 \times 7$

Hab. Pegu; Thayetmyo; Upper Burma, Tsingu near Ava (*W. T. B.*).

This species resembles *M. subjecta* (p. 98), but is distinguished by being more lustrous and globose, and by its narrower last whorl and smaller mouth, as well as by its longitudinal striation, which is sometimes difficult of detection.

a''. *Longitudinally (spirally) striated.*

182. **Macrochlamys kumahensis**, *Theob. & Stol. J. A. S. B.* 1872, p. 334, pl. 11, figs. 9, 10; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 531; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 25.
Nanina ramriensis, *Blf.*, *Nevill*, *Hand-l.* i, 1878, p. 24 (no description).

Shell openly perforate, depressed (almost subglobose), thin, smooth, polished, with close, minute, longitudinal (concentric) striation, only visible under a microscope, above and below, yellowish to brownish tawny; spire low, suture rather well impressed; whorls $4\frac{1}{2}$, convex, subangulate outside the suture; the last considerably broader, well rounded at the periphery and rather tumid below; aperture oblique, roundly lunate, almost circular; peristome thin, straight, columellar margin much curved, becoming vertical above, and rather broadly triangularly expanded.

Major diam. $9\frac{1}{2}$, min. $8\frac{1}{2}$, height $5\frac{1}{2}$ mm.

The form named *ramriensis* (but never described) is slightly larger, measuring $10\frac{1}{2}$ mm. in diameter, and has a rather larger mouth, but, as suggested by Nevill, is not distinguishable.

Hab. Kumah Hill near Sandoevay, Arakan (*Theobald*); Ramri Island, Arakan coast (*W. T. B.*). Also recorded from Bhamo, the Dafla Hills, and Borpani, Assam, with doubt by Nevill. [These are different species.]

A well-marked species, somewhat resembling *M. subjecta* in shape.

183. **Macrochlamys causia**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 388; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 118; *H. & T.* (Helix) *C. I.* 1876, pl. 90, figs. 2, 3; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 36, no. 142 [from Salwin River is the next species].

Shell perforate, subglobosely depressed, rather solid, obliquely striated and, under the microscope, marked with minute, close, spiral (longitudinal) lines, smooth, not highly polished, pale yellowish horny, whiter beneath; spire conoidal, apex obtuse, suture impressed; whorls 5, convex, the last considerably broader, rounded at the periphery, moderately swollen beneath; aperture large, oblique, roundly lunate; peristome thin, straight, columellar margin vertical, produced forward around the perforation and sharply reflected.

Major diam. $6\frac{1}{2}$, min. $5\frac{1}{2}$, height 4 mm.

Hab. Phiethan, Tenasserim Valley (*Theobald*); Salwin River (*Hungerford*, teste *Nevill*).

b'. *Subglobosely depressed.*

a'''. *Smooth.*

[184. **Macrochlamys salwinensis,** *Godwin-Austen, Mol. Ind.* ii, 1907, p. 163, pl. 109, fig. 9.

Locality. Salwin Valley.

Shell globosely conoid, scarcely perforate, quite smooth; colour ochraceous; spire moderately high, apex rounded; whorls 5, regularly increasing, somewhat convex; aperture oblique, semi-ovate; columellar margin vertical; peristome slightly reflected.

Size: maj. diam. 6·7, min. 5·8; alt. axis 3·5, body-whorl 2·8 mm.

This shell was sent by Mr. Nevill to me as No. 142, p. 36, of his 'Hand-list,' *Nanina* (*Microcystis*) *causia*, Bs., from the Salween. It agrees very well with the figure in the Conch. Indica (pl. 90, figs. 2, 3), which was possibly a typical specimen, as it is recorded on p. 37 as from Phiethan, Tenasserim, and should now be found in the McAndrew Collection at Cambridge, among Benson's shells.]

185. **Macrochlamys ? dugasti,** *Morelet, Jour. Conch.* 1891, pp. 25, 239, pl. 5, figs. 1, 1*a*; *Blf. Proc. Mal. Soc.* v, 1903, p. 275.

Helix cycloidea, *apud H. & T. C. I.* 1878, pl. 88, figs. 8, 9; *Nevill,* Nanina (Microcystis), *Hand-l.* i, p. 36 (1878); *Theob.* (Macrochlamys) *Cat.* 1876, p. 18; *Kobelt* (Macrochlamys), *Mart. & Chemn. Syst. Conch.-Cab.* 1901, p. 1040, pl. 265, figs. 10, 11: *nec* Nanina cycloidea, *Albers, Mal. Bl.* iv, 1857, p. 89, pl. 1, figs. 1–3.

Shell perforate, subglobosely depressed, deep, thin, horny, isabelline, often paler beneath, polished, without longitudinal (spiral) sculpture; spire low, conoidal, suture impressed; whorls 6–8, closely wound, convex above, the last but little broader, much rounded at the periphery, not tumid beneath; aperture

Fig. 48.—*Macrochlamys dugasti.*

oblique, sometimes descending slightly, broadly lunate, much broader than high; peristome blunt, whitish, basal margin slightly arcuate, columellar obliquely curved, not vertical, brought forward and slightly reflected at the perforation.

[Only a part of the animal has been seen by me in a dried-up specimen, on soaking it out. The foot is divided longitudinally into three areas; there were the usual peripodial fringe and grooves, and a short overhanging lobe above the mucous pore. The jaw is curved slightly, but has no median projection on the cutting-edge. The teeth of the radula are arranged in rows

of 40 . 2 . 9 . 1 . 9 . 2 . 40 (51 . 1 . 51) teeth. The median tooth is tricuspid; the admedians have each a single cusp on the outer side; the marginals are minute and bicuspid. The genitalia could not be made out.]

Major diam. 13½, min. 12, height 9 mm.

Hab. Near Moulmein (*Theobald*); Phaboo, Salwin Valley (*Hungerford*). Common in the Upper Menam Valley and around Ching Mai in Siam.

There is some variation in size and in the height of the spire: a small Burmese specimen measures 12, 11, and 7½ mm. in its three diameters, a large Siamese shell 15, 13½, and 9½. The species is easily distinguished from all other Burmese and Indian *Macrochlamys* by its great height compared with its diameter. It is impossible to identify it with Albers's *Nanina cycloidea*, which measured 20 mm. in major diam. by only 9 in height, and which was of unknown origin, though supposed to be Himalayan.

b″. *Depressed or conoidly depressed.*

b‴. *Smooth.*

186. **Macrochlamys subpetasus**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1888, p. 211, pl. 53, fig. 7 (shell).

Helix aspides?, *Blf.* (*nec Bs.*) *J. A. S. B.* 1865, pt. 2, p. 86.

Shell minutely and subobtectly perforate, convexly depressed, polished, smooth, without sculpture, light brown; spire low, convexly conoidal, suture slightly impressed; whorls 6, convex, increasing slowly, the last rounded at the periphery, convex beneath; aperture subvertical, lunate; peristome thin above, basal margin slightly obtuse, columellar oblique, much curved, slightly expanded, more so near the perforation.

Major diam. 8, min. 7½, height 4 mm.

Hab. Arakan Hills on west side near Tongoop, and Bassein District, Pegu, west of Bassein River. Common.

187. **Macrochlamys noxia**, *Blf. P.Z.S.* 1904, ii, p. 444, pl. 25, fig. 14.

Shell minutely and subobtectly perforate, depressed, thin, smooth, polished, without sculpture, rufescent brown (light chestnut), whitish beneath except near the periphery; spire very low, conoidal, suture impressed; whorls 6, convex, not increasing rapidly, the last rounded at the periphery, convex beneath; aperture slightly oblique, lunate; peristome thin, basal margin arcuate, columellar oblique, briefly reflected above.

Major diam. 9, min. 8, height 4 mm. A large shell measures 10 × 9 × 4½.

Hab. Bassein District, Pegu, west of Bassein River.

A variety from Akyab in Arakan has 5 whorls and a slightly higher spire.

This is distinguished from *M. hypoleuca* by being more depressed and more narrowly perforate, and by the complete want of sculpture, and from *M. subpetasus* by larger size, lower spire, &c.

b⁴. *Longitudinally striated.*

188. **Macrochlamys nebulosa**, *Blf.* (Nanina) *J. A. S. B.* 1865, p. 66; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 79; *H. & T.* (Helix) *C. I.* 1876, pl. 64, figs. 8, 9, 10; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 23.

Shell perforate, conoidly depressed, sublenticular, thin, pale horny, not polished, but with a dull greasy lustre above, more polished below, smooth, minutely spirally striated (the striæ only visible under a microscope) above, not below; spire low, conoid, suture impressed; whorls 6, convex, slowly and regularly increasing, the last a little wider, subangulate at the periphery, angulate in young shells, convex beneath: aperture slightly oblique, roundly lunate, breadth exceeding height; peristome thin, columellar margin slightly expanded, almost vertical and briefly reflected above.

Major diam. 12, min. 11, height 6 mm.

Hab. Northern Pegu; Akoutoung, S. of Prome, Thayetmyo.

Chiefly distinguished by its dull greasy lustre above and subangulate or angulate periphery.

189. **Macrochlamys notha**, *Blf. P. Z. S.* 1904, ii, p. 444, pl. 25, fig. 19. Nanina petasus, *Blf.* (*nec Benson*) *J. A. S. B.* 1865, 2, p. 86.

Shell perforate, depressed, not highly polished, smooth to the eye or faintly striated, but under the microscope ornamented above and below with fine close concentric (longitudinal) parallel raised lines, which, under a higher power, are found to be rows of minute moniliform tubercles, yellowish tawny; spire low, conoidal, apex subacute, suture impressed; whorls 6–7, slightly convex, slowly increasing, the last rounded at the periphery, convex beneath; aperture very slightly oblique, almost vertical, lunate; peristome thin, basal margin arcuate, columellar slightly expanded, very briefly vertical above, then obliquely curved.

Major diam. 11½, min. 10½, height 6 mm.

Hab. Tongoop Pass, Arakan Hills, and neighbourhood of Thayetmyo, Pegu.

This shell resembles the Tenasserim *M. petasus* (p. 115) closely in shape and colour, and I long regarded the two as identical; but *M. notha* is distinguished by wanting the labiation of the Tenasserim species, by being less polished, and by its sculpture, which can only be seen under a microscope.

190. **Macrochlamys hypoleuca**, *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 67; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 104; *H. & T.* (Helix) *C. I.* 1876, pl. 64, figs. 6, 7; *Nevill* (Macrochlamys), *Hand-l.* i, 1878, p. 26.

Shell openly perforate (narrowly umbilicated), depressed, thin, smooth, polished, with very fine microscopic spiral (longitudinal) striation (which is often obsolete) above and below; chestnut above, whitish beneath; spire very low, conoidal, suture impressed;

whorls 5, not increasing rapidly, convex, the last rather broader, rounded at the periphery, convex beneath; aperture slightly oblique, broadly lunate; peristome acute, basal margin faintly arcuate, columellar margin curved, vertical and reflected above.

Major diam. 12, min. 10½, height 6 mm.

Hab. Pegu, the types from Akoutoung on the Irrawady below Prome; also found at Thayetmyo, and according to Nevill at Bhamo.

Easily recognized by its peculiar coloration. The sculpture is often obsolete on the upper surface, but can generally be seen beneath by the help of a microscope.

191. **Macrochlamys spreta**, *Blf. P. Z. S.* 1904, ii, p. 445, pl. 25, fig. 12.

Shell minutely and subobtectly perforate, depressed, thin, smooth, polished, finely striated with microscopical spiral (longitudinal) impressed lines above and below; light rufescent brown (pale chestnut), whitish at the base around the perforation; spire low, conoidal, suture shallow; whorls 5, convex, the last rather broader, rounded at periphery, convex beneath; aperture oblique, subovately lunate; peristome thin, straight, columellar margin oblique, slightly reflected.

Major diam. 8, min. 7, height 3½ mm.

Hab. Thamandewa, Bassein District, and other places west of the Irrawady River in Pegu.

This resembles *M. hypoleuca* and *M. noxia* in colour and form, but is distinguished by its marked longitudinal sculpture as well as by its smaller size.

[192. **Macrochlamys andersoniana**, *Nevill.*

Nanina honesta, *var.* andersoniana, *Nevill*: *vide* Appendix to Genus, p. 141.

M. honesta, *var.* tenuior, *Nevill, MS.*: *vide* Appendix, p. 141.]

[**Macrochlamys honesta**, *Gould*, which was inserted here in Dr. Blanford's MS., is placed in a new subgenus.]

193. **Macrochlamys patens**, *Blf. P. Z. S.* 1904, ii, p. 445, pl. 25, fig. 15.

Shell narrowly but perspectively umbilicate, conoidly depressed, sublenticular, smooth, polished, marked with parallel microscopic spiral (longitudinal) impressed lines, not close together, but at irregular intervals, above and below, tawny brown; spire conoidal, suture slightly impressed; whorls 4½, convex, the last rather broader, bluntly angulate at the periphery, convex beneath, compressed around the umbilicus; aperture diagonal, subtrapezoidal, almost securiform; peristome thin and straight, columellar margin oblique, triangularly reflected.

Major diam. 7, min. 6, height 3½ mm.

Hab. Irrawady Valley, Pegu; Thayetmyo, Bassein.

In many respects this shell resembles *M. honesta*, but is

distinguished by its umbilicus, sculpture, &c., besides its very much smaller size.

Animal light grey. A very small lobe overhangs the small mucous pore.

c. *Shells not exceeding 6 mm.*

(Generic position very doubtful.)

a'. *Turbinate.*

194. **Macrochlamys? pungi**, *Theobald* (Helix), *J. A. S. B.* 1859, p. 307; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 134; *H. & T. C. I.* 1876, pl. 16, fig. 9; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 38; *Godwin-Austen* (Macrochlamys?), *Mol. Ind.* i, 1882, p. 90, pl. 14, fig. 1 (shell).

Macrochlamys poongi, *Theobald, Cat.* 1876, p. 19.

Shell perforate, turbinate, rather thin, chestnut-brown, with very close microscopic sculpture of fine impressed longitudinal lines, hardly visible on the upper whorls; spire conoidal, suture deep; whorls $6\frac{1}{2}$, convex, regularly increasing, the last not descending, rounded at the periphery and below; aperture almost vertical, roundly lunate; peristome thin, right margin slightly arcuate, columellar slightly expanded, vertical above and triangularly reflected.

Major diam. 6·5, min. 6, height 5 mm.

Hab. Moulmein (*Theobald, Stoliczka*).

Near *M.? molecula*, but larger and higher in the spire. The measurements are those of a large adult shell; smaller specimens are 5 to 6 mm. across.

b'. *Depressed or conoidly depressed.*

a''. *Smooth.*

195. **Macrochlamys? molecula**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 389; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 69; *Stol.* (Microcystis) *J. A. S. B.* 1871, 2, p. 251, pl. 18, figs. 11–13 (anatomy); *H. & T.* (Helix) *C. I.* 1876, pl. 32, figs. 8, 9; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 38; *Godwin-Austen*, *Mol. Ind.* i, 1882, p. 88, pl. 16, fig. 8 (shell).

Shell narrowly perforate, depressedly conoidal, thin, smooth, without longitudinal sculpture, brownish horny, approaching pale chestnut in colour; spire low, conoid, with convex sides and obtuse apex, suture well impressed; whorls $5–5\frac{1}{2}$, rather closely wound, convex above, the last rounded at the periphery and convex beneath; aperture scarcely oblique, broadly lunate; peristome thin, straight, columellar margin oblique, slightly curved, very briefly reflected above.

Major diam. 5, min. 4, height 3 mm.

Hab. Rangoon (*Theobald*), Moulmein (*Stoliczka*), common; also Kalima Doung, near Ava (*W. T. B.*); Assam? and Khasi Hills? (teste *Nevill*); Lampun, Siam (*Daly*, see Proc. Mal. Soc. v, p. 275). A common and widely distributed form.

Animal grey to black; foot narrow, sole with two grooves.

Left mantle-lobe (shell-lobe) reflected over the outer lip, but not much produced; right mantle-lobe above shortly linguate. Tail-gland distinct, with a hook-like appendage above. Genitalia simple; no spermatheca nor dart-sac was seen; penis very simple, with a small kalc-sac at the point where the vas deferens joins. Jaw broad, smooth, with a projection in the middle inside. Teeth of radula in straight transverse rows of about 120 each; middle tooth of each row represented as quinquecuspid*, having two lateral cusps on each side, the terminal cusp long, pointed, and curved; inner laterals with two outer lateral cusps and one inner one; outer laterals bicuspid, with an outer basal lateral projection. (From Stoliczka's notes.)

196. **Macrochlamys? curvilabris,** *Blf. P. Z. S.* 1904, ii, p. 445, pl. 25, fig. 13.

Shell perforate, depressed, brownish, smooth, polished, scarcely striated; spire very long, suture well impressed; whorls $5\frac{1}{2}$, regularly increasing, convex above, the last descending somewhat towards the aperture, rounded at the periphery, flatly convex beneath; aperture oblique, broadly lunate; peristome obtuse, white and thickened inside, and much curved, upper margin slightly arcuate, basal prominently curved forward in the middle, columellar oblique, slightly reflected.

Major diam. $5\frac{1}{2}$, min. 5, height 2 mm.

Hab. Arakan Hills west of Prome.

This is the small form, "with the curvature and thickening of the peristome exaggerated," mentioned amongst the Burmese shells collected by me in 1860–62 (J. A. S. B. 1865, 2, bottom of p. 86). It is almost a miniature of *M. aspides*.

b''. *Longitudinally striated.*

197. **Macrochlamys? perpaula,** *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 390; *Pfr.* (Helix) *Mon. Hel.* v, 1886, p. 69; *Nevill,* Nanina (Microcystis), *Hand-l.* i, 1878, p. 37; *Godwin-Austen, Mol. Ind.* i, 1882, p. 89, pl. 14, fig. 5.

Shell minutely perforate, depressedly globose, smooth, not polished, obliquely striated, and very minutely spirally (longitudinally) ribbed throughout, umber-brown; spire conoidly convex, apex blunt, suture impressed; whorls 4, gradually increasing, convex, the last rounded at periphery and below; aperture oblique, lunate; peristome straight, acute, columellar margin oblique, slightly reflected above.

Major diam. 2, min. $1\frac{2}{3}$, height $1\frac{1}{3}$ mm.

Hab. Phiethan, Tenasserim (*Theobald*), Moulmein (*Stoliczka*). Nevill refers to this species shells from Thayetmyo, Arakan, Darjiling, and Pareshnáth [the last two are very unlikely].

Allied to *M. molecula*, but, besides its much smaller size, it is more globose (*Benson*).

* This may be due to an error of observation, as in the case of *Sitala infula*.

198. **Macrochlamys? pauxillula**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 390; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 119; ? *H. & T.* (Helix) *C. I.* 1876, pl. 90, figs. 7, 8, 9; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 37.

Shell perforate, depressed, thin, brownish horny, polished, marked with close, very fine, longitudinal (spiral) lines above and below; spire convex, suture impressed; whorls 4, convex, regularly increasing, the last rounded at periphery and below; aperture oblique, broadly lunate; peristome thin, straight, columellar margin curved, expanded and carried slightly forward above.

Major diam. $2\frac{3}{4}$, min. $2\frac{1}{4}$, height $1\frac{1}{4}$ mm.

Hab. Thayetmyo, Pegu (*Theobald, W. T. B.*); Prome.

The specimens described above, though somewhat larger, agree with Benson's description and are from the same locality. The shell figured in the 'Conchologia Indica' looks different, and may be *M. curvilabris*.

Another form, also from Thayetmyo, is thicker; it has a higher, more convex spire, and stronger concentric striation. This may be regarded as a variety.

F. Species from Andaman and other Islands in Bay of Bengal.

a. *Depressed.*

199. **Macrochlamys choinix**, *Bs.* (Helix) *A. M. N. H.* (3) vii, 1861, p. 83; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 117; *H. & T.* (Helix) *C. I.* 1876, pl. 51, fig. 1; *Godwin-Austen, Mol. Ind.* i, 1883, p. 102, pl. 22, fig. 6; ii, 1898, p. 48; *id. A. M. N. H.* (6) ii, 1888, p. 57.

Shell obtectly perforate, depressed, thin, translucent, scarcely striated, smooth, with fine, close, spiral (longitudinal) lines, only visible under a strong lens, on the upper surface, brownish horny; spire very low, suture scarcely impressed, almost flat; whorls 5, flat above, the inner rather closely coiled, the last broader, subangulately rounded at the periphery, moderately convex beneath; aperture oblique, large, broadly lunate; peristome sharp, upper margin arcuate, columellar much curved, vertical above and briefly reflected, partly covering the perforation.

Major diam. 16, min. 14, height 7 mm.

Hab. Mount Harriet, South Andaman.

Distinguished by few whorls, much broader last whorl, and the flattened upper surface. The animal, according to Nevill, is very active and throughout black, except the sole of the foot, which is white.

Macrochlamys choinix, var. *gigantea*, Nevill (G.-A., P. Z. . 1895, p. 446; Mol. Ind. ii, p. 48), from South Andaman Island, has never been described.

200. **Macrochlamys pseudochoinix**, *Blf. P. Z. S.* 1904, ii, p. 446, pl. 25, fig. 10.

Shell subobtectly perforate, depressed, thin, smooth, slightly polished, brownish horny, subobsoletely plicately striated transversely and marked with fine, close, microscopic, slightly flexuous, spiral (longitudinal) lines above and below; spire very low, suture scarcely impressed, almost flat; whorls 5, rather flat above, the last much broader, rounded at the periphery, swollen beneath; aperture oblique, subdiagonal, large, subovately lunate; peristome acute, upper margin arcuate, columellar much curved, vertical above, briefly reflected, partly covering the perforation.

Major diam. 14, min. 12, height 7 mm.

Hab. Great Cocos Island, Bay of Bengal.

Near *M. choinix*, but considerably more tumid beneath, with rather higher spire and much stronger spiral sculpture. The aperture is much rounder, being very little broader than high, $7 \times 7{\cdot}5$ mm., whilst in a specimen of *M. choinix* the dimensions are $7 \times 8{\cdot}5$ mm.

201. **Macrochlamys exul**, *Theob.* (Helix) *J. A. S. B.* 1864, p. 245; *Stol.* (Helix) *P. A. S. B.* 1870, p. 87; *H. & T.* (Helix) *C. I.* 1876, pl. 62, figs. 1, 2, 3; *Nevill, Hand-l.* i, 1878, p. 23; *Godwin-Austen, Mol. Ind.* i, 1883, p. 103, pl. 22, fig. 3 (shell); ii, 1907, p. 165, pl. 111, figs. 2–2 *d* (part of animal, genitalia, & radula).

Orobia (Helix) andamanensis, *Tryon, Am. Jour. Conch.* v, 1869–70, p. 110, pl. 10, fig. 4; *Pfr. Mon. Hel.* vii, 1876, p. 108.

Shell subobtectly perforate, conoidly depressed, smooth, not highly polished, with fine, close, longitudinal striation (sometimes indistinct) under the microscope, translucent, light brownish horny; spire low, conoidal, sides rather convex, apex obtuse, suture shallow; whorls 6, gradually increasing, the last somewhat compressed and very bluntly angulate at the periphery, convex beneath; aperture oblique, lunate, almost semioval; peristome thin, columellar margin oblique, triangularly reflected above, partly covering the perforation.

Major diam. $15\frac{1}{2}$, min. 14, height $7\frac{1}{2}$ mm. A large specimen measures $17 \times 15\frac{1}{2} \times 8$.

Hab. Port Blair, in South Andaman.

The height of the spire varies, and immature specimens appear flatter, more closely wound, and much more angulate than adults. Such shells appear to be frequently mistaken for *M. stephus*, but may be distinguished by the subangulate periphery and oblique aperture.

[Animal ochraceous in spirit. Foot divided on the sole, extremity rounded; mucous gland large, with a blunt overhanging lobe. Right and left shell-lobes are present, the latter apparently larger than usual in the genus. In the generative organs the penis has a coiled cæcum; a long retractor muscle given off from it. The

epiphallus thence to the junction of the vas deferens is very long, and at the junction gives off a long kalc-sac. The amatorial organ is long. The spermatheca consists of an oval sac at the end of a thickened stem.

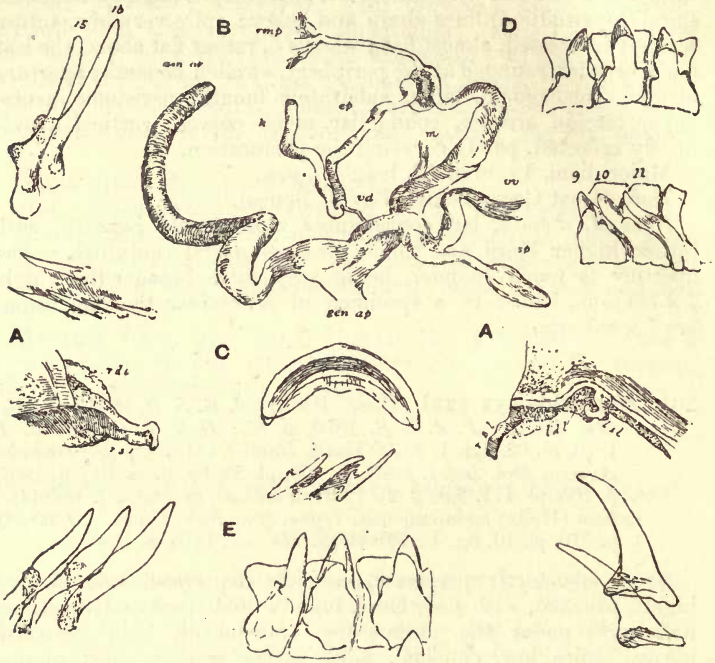


Fig. 49.—*Macrochlamys exul.*

A. Portions of the mantle-zone showing shell- and dorsal lobes. ×3·3.
B. Generative organs. ×6.
C. Jaw. ×18.
D. Teeth of the radula.

Macrochlamys beata.

E. Teeth of the radula. ×413.

Jaw moderately curved, with a slight median projection.
Radula formula:

$$35 \,.\, 1 \,.\, 10 \,.\, 1 \,.\, 10 \,.\, 1 \,.\, 35$$

or

$$46 \,.\, 1 \,.\, 46$$

Central tooth rather short, with small blunt basal cusps; the admedian teeth on quadrate plates, blunt cusps low down on outer margin; the laterals are long, aculeate, and slightly curved, becoming very short on the outer margin.

This radula is very different from that of typical *Macrochlamys*, and so is the genitalia, and if it should be common to all the Andaman species it would constitute them a good subsection.

Aculeate laterals have been noticed in the following species :— *M. jainiana*; *M. castaneo-labiata*; in *M. tugurium* the outermost teeth; and in *M. dalingensis* they are nearly aculeate.]

202. **Macrochlamys stephus**, *Bs.* (Helix) *A. M. N. H.* (3) vii, 1861, p. 84; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 105; ? *H. & T.* (Helix) *C. I.* 1876, pl. 62, figs. 4, 5, 6; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 23; *Godwin-Austen*, *A. M. N. H.* (6) ii, 1888, p. 56; *id. P. Z. S.* 1895, pp. 441, 446; *id. Mol. Ind.* ii, 1898, p. 50.

Shell narrowly perforate, depressed, smooth, with faint microscopic traces of minute, close, spiral (longitudinal) striation, polished, pale yellowish or greyish brown; spire very depressedly conoidal, suture faintly impressed; whorls 6–7, slightly convex above, increasing slowly and regularly, the last rounded outside, obtusely subangulate above the periphery in immature shells, convex beneath; aperture slightly oblique, lunate; peristome thin, upper margin straight, basal slightly arcuate, columellar oblique, expanded throughout the greater part of its length, more broadly above.

Major diam. $12\frac{1}{2}$, min. 11, height nearly 6 mm. A rather smaller specimen with 6 whorls measures $11\frac{1}{2} \times 10\frac{1}{2} \times 5$ mm.

Hab. Mount Harriet, Port Blair, South Andaman Island.

Benson's type measured only 10 mm. in major diameter.

The figures in the 'Conchologia Indica' are not good, and perhaps represent a different shell. *M. stephus* may be recognized by its closely-wound whorls, low spire, and want of distinct sculpture under the microscope.

Animal throughout yellow, except the tentacles, which are black, sole of foot also yellow (*Nevill*).

[In a specimen recently examined, sent home by Mr. G. Rogers from South Andaman Island, a minute left shell-lobe is present, contracted and hooked in the spirit-specimen. Preserved in this way and brittle, it would very readily be broken off. The penis has a small coiled cæcum; the jaw a small central projection. In the radula the laterals are slightly curved aculeate teeth, and the formula is

$$\begin{matrix} 30 \,.\, 1 \,.\, 10 \,.\, 1 \,.\, 10 \,.\, 1 \,.\, 30 \\ 41 \,.\, 1 \,.\, 41 \end{matrix}$$

in all respects similar to that of *M. exul*.]

*203. **Macrochlamys woodmasoni**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1888, p. 209, pl. 53, fig. 2.
Macrochlamys woodmasoniana, *Godwin-Austen*, *P. Z. S.* 1895, pp. 441, 446.

"Shell not quite mature, perforation minute, very depressedly

globose, glassy, rather solid; sculpture quite smooth; whorls 6, closely wound, flat above, subangulate above on periphery.

"Major diam. 9·5, min. 8, alt. axis 3·5, body-whorl 2·8 mm." (*Godwin-Austen.*)

Hab. Little Cocos Island, Bay of Bengal.

The figure represents a discoidal form, not unlike that of *M. consepta*, with a scarcely exserted spire. The shell is deep and tumid beneath, and the greatest diameter much nearer to the spire than to the base.

b. *Depressedly conoid, more or less lenticular.*

204. **Macrochlamys aulopis**, *Bs.* (Helix) *A. M. N. H.* (3) xi, 1863, p. 318; *H. & T.* (Helix) *C. I.* 1876, pl. 30, figs. 8, 9; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 32.

Helix aulopsis, *Pfr. Mon. Hel.* v, 1868, p. 93; *Godwin-Austen* (Macrochlamys), *P. Z. S.* 1895, p. 446.

Shell openly perforate, subumbilicate, depressedly conoid, lenticular, smooth, slightly polished, minutely decussated beneath a lens by transverse and rather distinct longitudinal lines both above and below, thin, translucent, greyish-brown horny; spire conoidal, suture very slightly impressed; whorls 5, gradually increasing, flatly convex above, the last sharply carinate at the periphery, moderately convex beneath; aperture oblique, quadrately lunate, subsecuriform; peristome thin, columellar margin slightly oblique, carried forward, and triangularly reflected above.

Major diam. 12, min. 10, alt. 6 mm.

Hab. South Andaman Island, not common.

Animal light grey, mottled with a darker shade (*Nevill*). Right shell-lobe well developed. Teeth on radula +20 . 8 . 1 . 8 . 20+ about.

205. **Macrochlamys pseudaulopis**, *Godwin-Austen* (*Nevill, MS.*), *A. M. N. H.* (6) ii, 1888, p. 56; *id. P. Z. S.* 1895, p. 447.

This is distinguished from *M. aulopis* by rather smaller size, brighter and more rufous-brown colour, by the longitudinal (spiral) sculpture above and below being less strong, and fine and close instead of distant, by the suture being rather deeper, the whorls more convex, the last whorl less sharply keeled and more swollen beneath, the aperture higher in proportion to the breadth, and the columellar margin vertical above and broadly reflected.

Major diam. 10, min. 8, height 5 mm.

Hab. South Andaman Island. Common on Mount Harriet (*Nevill*).

Animal blackish throughout.

206. **Macrochlamys fordiana.** *Godwin-Austen* (*Nevill, MS.*), *A. M. N. H.* (6) ii, 1888, p. 56; *id. P. Z. S.* 1895, p. 446.

Shell subobtectly perforate, depressedly conoid, bluntly keeled,

thin, pale yellowish to rufescent horny, not polished above, more so beneath, transversely striated and with subobsolete rather distant longitudinal (spiral) lines, and obliquely somewhat closely irregularly and flexuously rugate above, faintly decussated and much smoother below; spire conoidal, the sides convex, apex obtuse, suture almost flat; whorls 5, flatly convex above, the last rather broader, bluntly angulate at the periphery, slightly tumid beneath; aperture oblique, subovately lunate; peristome thin, in one plane, columellar margin curved, scarcely vertical above and briefly but broadly reflected, partly concealing the perforation.

Major diam. 18, min. 16, height 10 mm.

Hab. South Andaman.

Distinguished by its peculiar wrinkled surface. By this young specimens may be separated from *M. pseudaulopis*, which they otherwise resemble.

207. **Macrochlamys? perinconspicua**, *Godwin-Austen* (*Nevill, MS.*), *A. M. N. H.* (6) ii, 1888, p. 57.

Shell narrowly umbilicate, conoidly depressed, sublenticular, not very thin, slightly polished above, more brilliantly beneath, marked with fine, close, spiral or concentric (longitudinal) impressed lines above and below, brownish horny; spire conoidal, with the sides convex, apex obtuse, suture impressed; whorls 5, regularly increasing, convex; last whorl bluntly angulate at periphery, convex beneath; aperture oblique, subangulately and broadly lunate, subovate; peristome straight, basal margin mnch rounded, columellar vertical, slightly reflected.

Major diam. 7·5, min. 7, height 4 mm. Smaller shells measure 6 × 5 × 3·5 mm.

Hab. Little Brother Island, Andaman group.

This is probably not a *Macrochlamys*.

208. **Macrochlamys? battimalvensis**, *Godwin-Austen* (*Nevill, MS.*), *A. M. N. H.* (6) ii, 1888, p. 58.

Shell narrowly umbilicate, depressed, lenticular, compressedly carinate, not thin, smooth, finely transversely striated and decussated with microscopic rather distinct longitudinal impressed lines above and below, brownish yellow; spire low, conoidal, suture almost flat; whorls 4½, flatly convex, the last compressed above the prominent keel, more convex beneath, tumid around the deep pervious umbilicus; aperture oblique, subsecuriform; peristome thin (? immature), straight, columellar margin vertical, rather broadly reflected.

Major diam. 9·5, min. 8, height 4 mm.

Hab. Batti Malve, one of the Nicobar Islands.

This shell is not like any known *Macrochlamys*, and the only specimen may be immature.

G. Species from Indian Peninsula and Ceylon, having Rajputana, Central India, and Chutia Nagpur on the north.

(*Of the greater number the generic affinities are doubtful.*)

a. *Subglobosely depressed or subturbinate.*

a'. *Longitudinal sculpture present (microscopical).*

209. **Macrochlamys? tenuicula,** *H. Ad. P. Z. S.* 1868, p. 14, pl. 14, fig. 9; *Pf.* (Helix) *Mon. Hel.* vii, 1876, p. 94; *H. & T.* (Helix) *C. I.* 1876, pl. 89, figs. 7, 10; *Blf. J. A. S. B.* 1880, 2, p. 196, pl. 2, fig. 8.

Nanina (Macrochlamys) effulgens, *Nevill* (*Blf. MS.*), *Hand-l.* i, 1878, p. 26.

Nanina (Microcystis) tenuicola, *Nevill, Hand-l.* i, 1878, p. 36; *Peile* (Microcystina), *Jour. Bom. N. H. Soc.* xi, 1897, pp. 133, 262.

Shell openly perforate, subumbilicate, turbinate, thin, yellow or fulvous horny, polished, transparent, striatulate, and under the microscope finely decussated on the upper whorls with minute, close, impressed spiral (longitudinal) lines; spire subconical, the sides slightly convex, apex obtuse, suture slightly impressed; whorls $5\frac{1}{2}$–6, flatly convex above, rather closely wound, the last subangulate at the periphery (distinctly angulate in immature shells), convex beneath; aperture oblique, diagonal in the young, roundly lunate; peristome thin, straight, columellar margin much curved and nearly vertical above, turned back at the perforation.

Major diam. 9, min. 8, height 7 mm.

Hab. Bombay and the Western Ghats, Khandalla, Saltara, and, according to Nevill, Surat. I obtained young specimens in the Rajpipla Hills at Dholgaum.

The animal is nearly black; foot very long and narrow; shell-lobes to mantle small, pointed; a large lobe above the mucous pore.

This shell is easily recognized by its turbinate shape. The specimen originally described by H. Adams, 6 mm. in diameter, was immature. Some shells measure 10 mm. in major diameter. The young shell, however, with 4 whorls and the aperture diagonal and almost securiform, is thicker than older specimens and has all the appearance of an adult shell, the peristome being rather blunt.

b'. *No longitudinal sculpture.*

210. **Macrochlamys fragilis,** *Hutton* (Nanina), *J. A. S. B.* 1838, p. 216; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 48; iv, p. 30; *Bens.* Helix (Nanina), *A. M. N. H.* (2) ii, 1848, p. 163.

Shell openly perforate, subturbinately depressed, thin, polished, smooth, pale umber; spire conoidal, apex obtuse, suture impressed; whorls $4\frac{1}{2}$, convex, the last broader and ventricose, obsoletely subangulate at the periphery (more angulate in young), rather flatly

convex beneath; aperture oblique, subquadrately lunate; peristome thin, columellar margin incurved, vertical and rather broadly reflected above.

Major diam. 7½, min. 7, height 5 mm.

Hab. Kirmalliah, about 5 miles from Neemuch in Central India (*Hutton*).

The original specimens were found crawling on Dhak or Palás (*Butea frondosa*), and it is not clear that they were mature. The description is taken from two immature specimens in the British Museum, presented by Capt. Hutton. The diameter of Hutton's type was 0·35 in. (9 mm.). The species is allied to *M. tenuicula*, but is more openly perforate and less angulate at the pheriphery, besides wanting the longitudinal sculpture of that shell.

211. **Macrochlamys? lixa**, *Blf.* Nanina (Macrochlamys?), *J. A. S. B.* 1866, 2, p. 35; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 79; *H. & T.* (Helix) *C. I.* 1876, pl. 149, figs. 5, 6; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 26.

Shell subobtectly perforate, depressedly turbinate, subglobose, very thin, above dull, without lustre, and, besides the ordinary striation, marked with fine, close, flexuous, transverse impressed lines under the microscope, polished beneath, olivaceous or fulvous with an olive tinge; spire conoidal, suture impressed; whorls 6, convex, the last much broader, rounded at the periphery, tumid beneath. Aperture oblique, large, roundly lunate, almost as high as broad; peristome thin, straight, columellar margin slightly oblique, nearly vertical above, reflected, not broadly but so as partly to cover the perforation.

Major diam. 16, min. 14½, height 10 mm.

Hab. Orissa and Ganjam (*Ball*, *Beddome*). The locality originally given, Anaimalai Hills, appears to have been a mistake.

212. **Macrochlamys? hebescens**, *Blf.* Nanina (Macrochlamys), *J. A. S. B.* 1866. 2, p. 34; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 78; *H. & T.* (Helix) *C. I.* 1876, pl. 149, fig. 1; ? *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 26.

Shell scarcely perforate, conoidly depressed, yellowish or fulvous, thin, horny, dull (without lustre), marked with very close, microscopic, impressed, oblique (transverse, somewhat irregular and wavy) lines above, more polished and radiately striated below; spire low, apex rather acute, prominent, subacuminate, suture deep; whorls 5½, rounded, the first narrow, the last much broader, very bluntly subangulate at the periphery and tumid beneath; mouth large, nearly vertical, lunately subovate, breadth exceeding the height; peristome thin, straight, margins subdistant, united by a very thin callus, columellar margin nearly vertical above, very briefly and broadly reflexed, nearly covering the perforation.

Major diam. 15, min. 12½, height 8½ mm.

Hab. Jeypore, Vizagapatam. The locality originally given, Anaimalai Hills, is erroneous, as in the case of *M. infausta* and *M. lixa*.

This may perhaps be a variety of *M. lixa*, with a lower spire.

213. **Macrochlamys pedina**, *Bs.* (Helix) *A. M. N. H.* (3) xv, 1865, p. 13; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 100; *id.* vii, 1876, pp. 108, 530; *H. & T. C. I.* 1876, pl. 51, fig. 3; *Stol. J. A. S. B.* 1872, 2, p. 212, footnote; *Godwin-Austen, Mol. Ind.* i, 1898, pl. 21, fig. 13 (sculpture of inner whorls); *id.* ii, 1907, pp. 87, 133, pl. 83 (anatomy); *Peile* (Nanina), *Jour. Bom. N. H. Soc.* xi, 1897, p. 133; *Kobelt*, Nanina (Xestina), *Mart. & Chemn. Syst. Conch.-Cab.*, Zonitidæ, 1901, p. 980, pl. 254, figs. 4, 5; *id.* (Macrochlamys) *t. c.* 1901, p. 1021, pl. 263, fig. 2.

Helix vitrinoides, *Pfr.* (pt.), *Mart. & Chemn.* (*nec Desh.*) *Syst. Conch.-Cab.* 1901, pl. 110, figs. 10–12 (nec 13–15).

Shell rather openly perforate, conoidly depressed, very thin, translucent, polished below, less so above, smooth, without longitudinal sculpture, but minutely, closely, and flexuously striated, transversely on some of the inner whorls, yellowish to fulvous horny; spire very low, but varying in height, suture impressed; whorls $6\frac{1}{2}$, slightly convex above, the last broader, bluntly subangulate above the periphery, somewhat tumid beneath; aperture slightly oblique, roundly lunate; peristome very thin, columellar margin much curved, vertical and reflected above, partly covering the perforation.

Major diam. 30, min. $25\frac{1}{2}$, height $13\frac{1}{2}$ mm. Other specimens measure 30, $26\frac{1}{2}$, and $15\frac{1}{2}$, and 28, 23, and 13.

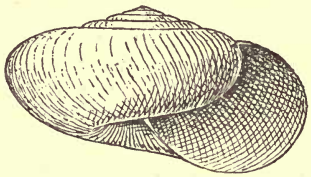


Fig. 50.—*Macrochlamys pedina.*

Hab. A considerable part of the Bombay Presidency. Common at Bombay and Khandalla, and reported from Cutch (*Stoliczka*), Poona, Singhar (*W. T. B.*), Ahmednagar, and South Canara (*Beddome*). The South Canara shell has a higher spire. A very similar form, perhaps a variety, is found at Karnul (*Beddome*).

Animal pale to dark grey or blackish in colour; shell-lobes well developed, right dorsal lobe ample, left dorsal lobes in two parts. Teeth in radula of usual form: 44 . 3 . 14 . 1 . 14 . 3 . 44 (61 . 1 . 61). The genitalia differ from those of typical *Macrochlamys* by the cæcum of the male organ not being coiled, [thus resembling much

more that of *Ariophanta*]. The spermatheca is very long and the dart-sac long and cylindrical.

This is the largest Indian peninsular species.

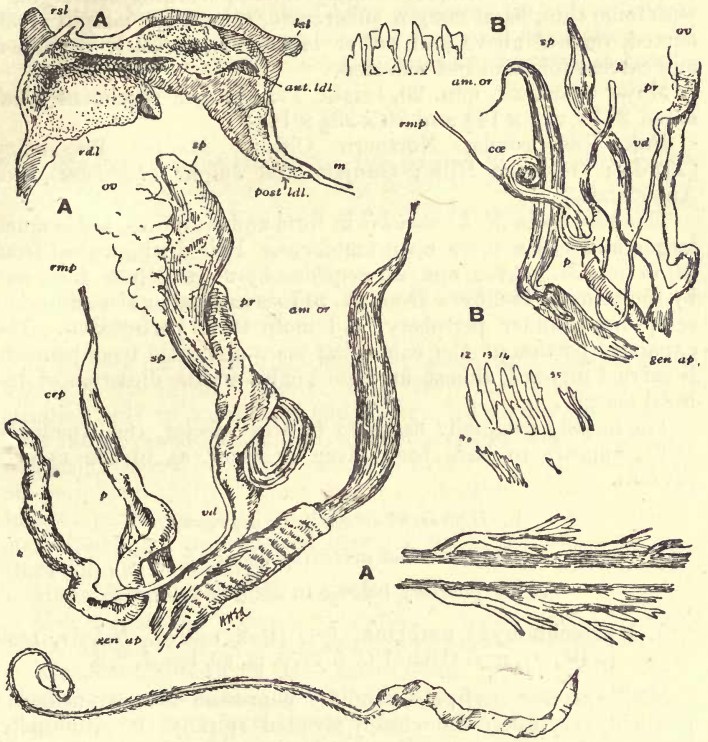


Fig. 51.—*Macrochlamys pedina.*

A. Mantle-edges, showing shell- and dorsal lobes. ×3.
Genitalia. ×3.
Spermatophore. ×3·4.
Ditto, portion of flume of. ×22·5.

Macrochlamys hardwickii.

B. Genitalia. Enlarged about 3 times.
Teeth of the radula.

214. **Macrochlamys infausta**, *Blf.* Nanina (Macrochlamys), *J. A. S. B.* 1866, 2, p. 36; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 124; *H. & T.* (Helix) *C. I.* 1876, pl. 159, figs. 2, 3.

Shell openly perforate, subumbilicated, conoidly depressed, subglobose, thin, translucent, with a dull greasy lustre above, glassy

below, brownish tawny; sculpture as in *M. hardwickii*, the longitudinal striæ very close and minute, only visible under a strong lens; spire low, conoidal, suture impressed; whorls 6, convex above, the last rather broader, rounded at the periphery, tumid beneath; aperture oblique, roundly lunate, margins converging; peristome thin, basal margin subarcuate, columellar margin much curved, vertical above and rather broadly triangularly expanded and carried forward, not reflected.

Major diam. 22, min. 20, height 14. Larger specimens measured $24\frac{1}{2} \times 22\frac{1}{2} \times 14\frac{1}{2}$ and $26 \times 23\frac{1}{2} \times 14\frac{1}{2}$.

Hab. Russelconda, Northern Circars, Madras Presidency (*Traill*); Golconda Hills; Ganjam and Jaipur (*Beddome*), not Anaimalais.

This resembles *M. hardwickii* in form and sculpture, but is much larger and has a more open umbilicus. It is distinguished from *M. indica*, *M. petrosa*, and *M. perplana* by more globose form and by sculpture. It differs from *M. pedina* in smaller size, different sculpture, rounder periphery, and more open perforation. The expanded portion of the columellar margin, viewed from beneath, is carried forward almost at right angles to the direction of the basal margin.

The locality originally assigned to this species, the Anaimalai Hills, appears to have been given in error, as in the case of *M. lixa*.

b. *Depressed or conoidly depressed.*

a'. *Diameter not exceeding about* 15 *mm.*

(May possibly belong to *Eurychlamys*.)

215. **Macrochlamys? umbrina**, *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 49; *H. & T.* (Helix) *C. I.* 1876, pl. 89, figs. 1, 2, 3.

Shell scarcely perforate, conoidly depressed, thin, translucent, polished, very finely and closely striated spirally (longitudinally) beneath the microscope, brownish tawny; spire low, conoid, suture impressed; whorls $4\frac{1}{2}$, convex, the last broader, rounded at periphery, flatly convex beneath, sunken around the perforation; aperture slightly oblique, lunate; peristome thin, straight, columellar margin oblique, reflected above, almost concealing the perforation.

Major diam. 8, min. 7, height $4\frac{1}{2}$ mm.

Hab. Ceylon, Badulla district (*Layard*).

216. **Macrochlamys? nepas**, *Pfr.* (Helix) *P. Z. S.* 1855, p. 91; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 24; *H. & T.* (Helix) *C. I.* 1876, pl. 132, figs. 1, 2.

Shell narrowly perforate, conoidly depressed, thin, smooth, polished, finely and closely striated spirally (longitudinally) beneath the microscope, orange-brown; spire conoid, suture impressed; whorls $4\frac{1}{2}$, convex, the last broader, rounded at the periphery, tumid at base; aperture subvertical, roundly lunate;

peristome thin, straight, columellar margin curved, vertical above and expanded, narrowly reflected.

Major diam. 7½, min. 6½, height 5 mm.

Hab. Ceylon.

The above description is taken from the typical specimens in the British Museum, but they differ somewhat in colour and in the shape of the mouth from Pfeiffer's original description. He described the shell as purplish brown, and the aperture as broadly lunate.

217. **Macrochlamys? woodiana**, *Pfr.* (Helix) *P. Z. S.* 1851, p. 254; *id.* (Helix) *Mon. Hel.* iii, 1853, p. 87; *H. & T.* (Helix) *C. I.* 1876, pl. 32, figs. 2, 3; *Nevill, Jour. Conchyl.* xxvi, 1878, p. 60; *id. Hand-l.* i, 1878, p. 22.

Helix carneola, *Pfr. P. Z. S.* 1854, p. 148; *id. Mon. Hel.* iv, 1859, p. 47; *H. & T. C. I.* 1876, pl. 128, figs. 2, 3.

Helix semifusca, *apud Pfr. Mon. Hel.* iv, 1859, p. 62, pt.: *nec Deshayes, vide Nevill, t. c.*

Shell very narrowly umbilicated, depressed, thin, smooth, glassy, yellowish to fulvous horny, with very fine indistinct spiral striation only visible when highly magnified; spire low, conoidal, apex rather prominent, suture well impressed; whorls 6, convex, increasing slowly, the last scarcely broader, bluntly subangulate at periphery, flatly convex below; aperture oblique, broadly lunate; peristome thin, basal margin slightly arcuate, columellar curved, oblique, not reflected over the umbilicus, but carried forward for a short distance.

Major diam. 12, min. 11, height 5½ mm.

Hab. Ceylon and Southern India; Trichinopoly, Kolamalai Hills, Arcot (*W. T. B.*); Myhendra, Travancore (*Beddome*).

A common species in the Carnatic and, apparently, in Ceylon. Nevill has shown that the true *Helix semifusca* of Deshayes, supposed to have been brought from Pondicherry, really came from Mauritius. At the same time the shell described by Pfeiffer is different from *woodiana*, as Nevill shows. The types of *H. woodiana* and *H. carneola* in the British Museum appear to me identical.

218. **Macrochlamys? rutila**, *Blf. P. Z. S.* 1904, ii. p. 443, pl. 25, fig. 11.

Shell perforate, depressed, glassy, polished, closely, minutely and regularly striated longitudinally (spirally) under the microscope above and below, light chestnut; spire very low, suture slightly impressed; whorls 6, convex, the last broader, rounded at the periphery, convex beneath; aperture slightly oblique, lunate; peristome thin, upper margin slightly arcuate, basal nearly straight, columellar oblique, briefly and triangularly reflected above.

Major diam. scarcely 15, min. 13, height 6 mm.

Hab. Anagundi Shola, Anaimalai Hills (*Beddome*).

219. **Macrochlamys? vallicola**, *Pfr.* (Helix) *P. Z. S.* 1854, p. 289; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 46; *H. & T.* (Helix) *C. I.* 1876, pl. 128, figs. 8, 9.

Shell perforate, depressed, smooth, highly polished, marked with fine, concentric (longitudinal), not very close, and slightly impressed lines (only visible under a microscope) above and faintly below; isabelline tawny, whitish beneath; spire almost flat, suture shallow, slightly impressed; whorls 5, slightly convex, the last rounded at the periphery, convex below; aperture subvertical, lunate; peristome thin, straight, columellar margin oblique, expanded, reflected above.

Major diam. 12, min. 10, height 5 mm.

Hab. Kundah Hills, the western part of the Nilgiris (*Pirrie*).

220. **Macrochlamys todarum**, *W. & H. Blf.* (Helix) *J. A. S. B.* xxx, 1861, p. 353, pl. 1, fig. 8; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 106; *H. & T.* (Helix) *C. I.* 1876, pl. 64, figs. 4, 5; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 26.

Shell subobtectly perforate, subturbinately depressed, thin, smooth, polished, minutely and closely striated concentrically (longitudinally) throughout beneath the microscope, rufescent brownish horny; spire conoid, apex acute, suture impressed; whorls 6, convex, the last considerably broader, rounded at periphery, convex below; aperture subvertical, roundly lunate; peristome thin, basal margin slightly arcuate, columellar curved, vertical above, triangularly reflected partially covering the perforation.

["Animal of Nilgiri specimen very similar to *H. vitrinoides* (i. e. *M. indica*, *petrosa*, &c.), and with precisely similar linguiform processes to the mantle. Back very narrow but not keeled above. Animal and mantle black."—*Extract from Dr. Blanford's Note-book.*]

Major diam. 14, min. 12, height 7½ mm.

Hab. Nilgiri Hills; Pykara, Neddiwuttom, 6000′, &c. Also reported from other parts of the Nilgiris, from Tinnevelly and from the Shevroys.

221. **Macrochlamys? perrotteti**, *Pfr.* (Helix) *Zeitschr. Mal.* 1851, p. 13; *id.* (Helix) *Mon. Hel.* iii, 1853, p. 63; *id. t. c.* vii, 1876, p. 110; *id.* (Helix) *Mart. & Chemn. Syst. Conch.-Cab.* 1901, Helix, no. 1088, pl. 159, figs. 41–44; *W. & H. Blf. J. A. S. B.* 1861, p. 353.

Shell perforate, depressed, thin, smooth, polished, with extremely minute and close microscopic spiral striation, brownish horny; spire very low, conoid, suture slightly impressed; whorls 5½, rather convex, the last rounded at the periphery and flatly convex beneath; aperture subvertical, lunate; peristome thin, basal margin slightly arcuate, columellar oblique, slightly curved, triangularly expanded, but scarcely reflected above.

Major diam. 8, min. 7, height 4 mm. A smaller form measures $7 \times 6 \times 3\frac{1}{2}$.

Hab. On the plateau of the Nilgiris, 6000–7000′; Pykara, Avalanche, &c. A common species. The longitudinal sculpture is not easily detected.

Hanley (Conch. Ind. p. vi, footnote 13) states that this species is African, but gives no evidence. Pfeiffer in the seventh volume of the Mon. Hel., published the same year (1876) as Hanley's work, gives the Nilgiris as the only locality.

222. **Macrochlamys? prava,** *Blf. P. Z. S.* 1904, ii, p. 443, pl. 25, fig. 9.

Shell perforate, depressed (the axis rather higher in proportion to the diameter), thin, smooth, polished, with traces of close, subobsolete, irregular, longitudinal striation visible under a microscope, brownish rufescent; spire low, conoidal, suture faintly impressed; whorls 5, convex, the last considerably broader, well rounded at the periphery and rather tumid below; aperture almost vertical,

Fig. 52.—*Macrochlamys prava.*

subovately lunate, almost circular; peristome thin, straight, columellar margin almost vertical, and slightly reflected above, curved below.

Major diam. 10½, min. 9, height 5½ mm.

Hab. Beypur, Malabar (*W. T. B.*), Anaimalai Hills (*Beddome*), Travancore. I have also specimens from Coonoor Ghat, Nilgiri Hills, apparently belonging to this form.

This resembles the Arakanese *M. kumahensis*, but is slightly less globose.

223. **Macrochlamys? vilipensa,** *Bs.* (Helix) *A. M. H. H.* (2) xii, 1853, p. 93; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 49; *H. & T.* (Helix) *C. I.* 1876, pl. 89, figs. 4, 5, 6.

Shell openly and perviously perforate, depressed, translucent, smooth, polished, amber-coloured or tawny; spire slightly convex, apex obtuse, suture impressed; whorls 2, slightly convex above, regularly increasing, the last rounded at the periphery, convex beneath; aperture scarcely oblique, broadly lunate; peristome thin, straight, columellar margin much curved, almost vertical above and reflected.

Major diam. 8, min. 7, height 4 mm.

Hab. Ceylon, Mehintali Rock (*Layard*); Calcad Hills, Travancore (*Beddome*).

This species resembles *M. nepos*, but is distinguished by narrower last whorl, lower spire, and much more open perforation.

c. *Upper surface transversely plicate or ribbed.*

224. **Macrochlamys? peringundensis,** *Bedd. P. Z. S.* 1891, p. 313, pl. 29, figs. 13, 14.

Shell minutely and subobtectly perforate, depressed, sublenticular, thin, translucent, polished, greenish horny, rather irregularly and obliquely plicately striated above, smooth beneath, very minutely (microscopically) sculptured longitudinally above and below with fine, close, papillose, irregular lines; spire low, conoidal, the height above the periphery less than that below, suture scarcely impressed; whorls $5\frac{1}{2}$, flattened above, the last broader, sharply angulate at the periphery, swollen below; aperture oblique, angulately lunate; peristome thin, straight, columellar margin curved, vertical and reflected above.

Major diam. 16, min. $13\frac{1}{2}$, height 8 mm.

Hab. Peringunda Hill, Anaimalais, 5000′.

Apparently an ally of *M. plicifera*, with similar microscopical sculpture, but distinguished by the plications not passing over the periphery and by other characters. Animal not known.

d. *Shells not exceeding about 6 mm. ($\frac{1}{4}$ inch) in diameter.*

(Generic affinities doubtful.)

a. *Depressed or conoidly depressed.*

b. *Smooth.*

225. **Macrochlamys? perfucata,** *Bs.* (Helix) *A. M. N. H.* (2) xii, 1853, p. 93; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 50.

"Shell scarcely perforate, depressed, translucent, purplish brown, highly polished; spire slightly raised, suture submarginate, apex obtuse; whorls 4, rather convex, closely wound, the last rounded, convex beneath; aperture lunate, scarcely oblique; peristome straight, sharp, columellar margin vertical, gently reflected; umbilicus not pervious.

"Major diam. 5, min. 3, axis 3 mm." (*Benson* in Latin.)

Hab. in the district of Galle, Ceylon (*Layard*).

I do not think the *Microcystina* from Bintenne and Matale (1800–2000′), north of the mountain complex in South-western Ceylon, can be the same as this species from Galle on the south coast, although referred to it by Godwin-Austen (Mol. Ind. ii, p. 110, pl. 92, fig. 4). It is quite possible that Benson's type, now no longer available, may have been immature, but the differences, especially in the character of the aperture, are too great to be attributed to age alone.

226. **Macrochlamys? tratanensis,** *Jousseaume* (Vitrea), *Mém. Soc. Zool. Fr.* vii, 1894, p. 270, pl. 4, fig. 11.

"Shell scarcely perforate, lenticular, depressed, thin, smooth, diaphanous, yellowish glassy, polished above, below obscurely and

radiately striated; spire scarcely raised, suture linear; whorls 4, depressed, convex, the last but little broader at the base, not descending; aperture nearly vertical, roundly semilunar; peristome simple, acute, thin, fragile, columellar margin reflected below and almost concealing the small umbilicus.

"Major diam. 5, min. 4, height 2 mm." (*Jousseaume* in Latin.)

Hab. Nuwara Ellia, Ceylon.

Probably not adult. The periphery is rounded, not angulate. Only two specimens were obtained. This might perhaps be *M. perfucata*, but as it inhabits the higher mountains of Ceylon it is not safe to identify it with a species living near the sea-level.

b'. *Longitudinally striated.*

227. **Macrochlamys? kandiensis**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1883, p. 90, pl. 14, fig. 2.

Shell perforate, conoidly depressed, rather solid, dark chestnut-brown, polished, finely, rather distantly striated longitudinally beneath the microscope above and below; spire low, convexly conoidal, apex obtuse, suture shallow; whorls 5, convex, the last well rounded at the periphery and moderately convex beneath; aperture slightly oblique, rather broadly lunate; peristome thin, columellar margin oblique, slightly curved and expanded, more reflected above.

Major diam. 3½, min. 3, height 2 mm.

Hab. Kandy, Ceylon.

228. **Macrochlamys? neherensis**, *Bs.* (Helix) *A. M. N. H.* (3) xiii, 1864, p. 210; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 164; *H. & T.* (Helix) *C. I.* 1876, pl. 32, figs. 5, 6; *Nev.* Nanina (Microcystis), *Hand-l.* i, 1878, p. 38.

"Shell narrowly and deeply (perspectively) umbilicate, depressed, obliquely striatulate, decussated above and below with very close spiral or concentric impressed lines; spire slightly convex, apex flattened, suture marginate, subcanaliculate; whorls 5, slightly convex, the last rounded at the periphery, convex beneath, excavated round the umbilicus; aperture oblique, broadly lunate; peristome thin, straight (in one plane), the margins joined by a thin minutely granulate callus; columellar margin subvertical, short, slightly reflexed.

"Major diam. 5, min. 4, axis 2 mm." (*Benson* in Latin.)

Hab. Mahableshwar and Khandalla (*Fairbank*).

The description is a translation of Benson's Latin one, except that I have omitted the term lenticular. I had specimens of this shell, but they have been crushed.

229. **Macrochlamys? atoma**, *Blf.* (*Fairbank, MS.*) *P. Z. S.* 1904, ii, p. 443, pl. 25, fig. 6.

Shell openly perforate, depressed, discoidal, rather solid, smooth, glassy, longitudinally (spirally) striated above and beneath under the microscope with regular, parallel, subdistant, impressed lines, whitish horny; spire very low, almost flat, suture impressed; whorls $3\frac{1}{2}$, regularly increasing, convex above, the last not descending, rounded at the periphery, flatly convex beneath; aperture slightly oblique, lunate; peristome thin, upper and basal margins moderately arcuate, columellar margin very oblique, almost horizontal, not reflected.

Major diam. 1·5, min. 1·2, height 0·6 mm.

Hab. Godavari Valley. I have obtained specimens from Paitan near Ahmednagar to below the first barrier at Dumagudlon, also in the Wardha and Penganga valleys. Found commonly with other shells amongst the débris deposited by river-floods and marking their highest level. I believe I also obtained this shell in the Nerbudda Valley. All specimens obtained were dead and usually milky white.

[Appendix to Macrochlamys.

No. 116 (p. 79). **Macrochlamys vesicula**, *Bs.*, should be **vesicula**, *Hutton.*

It is impossible now to ascertain on what shell Mr. Benson based his first description of this species; he believed it had a wide geographical range. Unfortunately, the exact locality of the shell Dr. Blanford has described is not specified, nor is it now to be found among his shells. The Murree specimens (p. 79) are distinct.

The *H. vesicula* of Hutton, 1837, was certainly Himalayan; he speaks of it as occurring from Monee Marjora, on edge of the plains, to Simla and the forest of Mahasu, 10,000 feet. He and Benson gave it an even greater range, as Dr. Blanford explains, p. 80. Thus it was that in 1852, fifteen years later, we find him giving an amended description of a shell he found at Soti Durga, at head of the Gangetic Delta, under the name *H. vesicula*. The typical specimens are in the McAndrew Collection at Cambridge, and now before me, marked Himalaya; but it is not the original label, these were all destroyed, and fresh substituted by McAndrew. These shells are unmistakably from Lower Bengal, and I can see nothing to distinguish them from *M. subjecta* of Rajmahal.

The two species from between Neemuch and Mhow, recorded by Captain Hutton as Nos. 28 & 29, J. A. S. B. 1834, pp. 520–21, and of which he gives descriptions of the animals (sufficiently good to distinguish them when some one finds them again), cannot

possibly be the same as the Himalayan *H. vesicula*. Hutton, who was a very accurate observer, noticed the difference between them: he says "they have no tentacular processes on the right side, no fleshy hook on the tail." No. 3 *Helix* of a previous paper in same Journal, February 1834, p. 83, was a *Macrochlamys*, and is now known as *M. petrosa*: "shell is like No. 29, but is more polished."

No. 192 (p. 121). **Macrochlamys andersoniana**, *Nevill.*

Nanina honesta, *var.* andersoniana, *Nevill, J. A. S. B.* 1877, 2, p. 16; *id. Yunnan Exped., Mol.* 1879, p. 874.
Nanina (Macrochlamys) honesta, *var.* andersoni, *Reeve, Conch. Ic.* pl. 84, fig. 452 (as *H. honesta*); *Nev. Hand-list*, i, 1878, p. 24.

Original description:—"This variety is distinguished (from typical *honesta*) by its less depressed shape, it is scarcely if at all angled at the periphery (the angulation being very distinct in the type form), the peristome not being so broadly reflected over the perforation; the substance and texture, perforation, shape of the aperture, and number of whorls are identical."

Type of var. *andersoniana* from Ponsee (*J. Anderson*).

Diam. 11, axis 6¼; apert. alt. 4, diam. 5½ mm.

Nevill records: *Hab.* Thyetmyo, Sibsagur, Naga and Khasi Hills, Chittagong and East Cachar, Dafla Hills, &c. I can only accept his Upper Burmah localities: Pudupyoo, 2nd Defile Irrawady, Nandin, and Ava. Specimens from Bhamo (*Anderson*) in my collection do not agree with the Assam shells, and I doubt the identification, many of the shells having been collected by and known to me. The description of the Bhamo shell is as follows:—

Shell globosely and depressedly conoid, narrowly umbilicated, rather solid; sculpture very smooth and glossy, longitudinal microstriation; colour pale horny with a greenish tinge; spire moderately high, slightly convex; suture adpressed; whorls 4½, sides above convex and well rounded on the periphery, the last slightly descending; aperture oblique, broadly lunate; peristome slightly thickened, straight, reflected considerably over the perforation.

Size: major diam. 10·3, minor diam. 8·5; alt. axis 5·0, alt. body whorl 4·0 mm.

Having examined the animal of *M. honesta* from Moolayit, Tenasserim, I have found considerable differences between it and *M. andersoniana*, especially in the radula; this last I consider a good species. It was apparently this species, or one very like it, which Stoliczka described in the Journ. Asiat. Soc. Bengal, 1871, at the bottom of pp. 249–250, with the figures on pl. xvii. of teeth of the radula, fig. 14, and the spermatophore, fig. 13.

No. 157. **Macrochlamys beata**, *Godwin-Austen.*

Teeth of radula are figured on p. 126, fig. 49 E.]

[*Key to Species of* Euplecta.

A. Shell turbinate or subturbinate, thin, horny, finely decussated above ..... *layardi.*
subdecussata.
baconi.
acalles.
pulchella.

B. Depressedly turbinate, or turbinate or lenticular, generally sharply keeled, with granular costulation or striation on upper surface ..... *semidecussata.*
rosamonda.
subcastor.
travancorica.
indica.
albizonata.
emiliana.
lævis.
binoyaensis.
verrucula.
fluctuosa.
prestoni.
scobinoides.
gardeneri.

C. Globosely conoid or depressed, with rounded periphery..... *subopaca.*
partita.
trimeni.

D. Conoidly depressed and carinate ..... *acuducta.*
isabellina.
colletti.

E. Trochiform.
a. Sculpture granular..... *cacuminifera.*
granulifera.
b. Sculpture finely decussated ..... *hyphasma.*
turritella.
c. Smooth ..... *mucronifera.*
phidias.
concavospira.
apicata.
orbiates.

F. Depressedly turbinate.
Finely decussate ..... *mucosa.*]

[*Key to Species of* Macrochlamys.

A. *Species from Himalayas west of Nepal.*
- *a.* Subglobose or subglobosely depressed, not labiate. — *vesicula.*
- *glauca.*
- *nuda.*
- *kuluensis.*

B. *Species from Eastern Himalayas (Sikhim and Western Bhutan).*
- *a.* Labiate ..... — *tugurium.*
- *mainwaringi.*
- *dalingensis.*
- *opipara.*
- *damsangensis.*
- *b.* Not labiate.
  - *a'.* Subturbinate ..... — *hodgsoni.*
  - *b'.* Depressed.
    - a^2. Spirally (longitudinally) sculptured ..... — *sequax.*
    - *sequius.*
    - *superflua.*
    - *rakaensis.*
    - b^2. Smooth ..... — *lubrica.*
      - a^3. Conoidly depressed, rugose transverse (but no longitudinal) sculpture ..... — *patane.*
      - *perfragilis.*
  - *c.* With free cæcum to male organ ..... — *richilaensis.*
  - *sathilaensis.*
  - *zemoensis.*
  - *d.* Shells not exceeding 6 mm.
    - b^3. Longitudinally striated or sculptured .. — *rorida.*
    - b^4. Smooth ..... — *darjilingensis.*

C. *Species from the Gangetic Valley and Delta, the N. W. Provinces, and Bengal with Rajmahal Hills.*
- *a.* Depressed or conoidly depressed ..... — *indica.*
  - *a'.* Longitudinal flexuous impressed sculpture .. — *petrosa* (type).
  - *b'.* Very fine microscopic striæ ..... — *hardwickii.*
- *b.* Smooth ..... — *subjecta.*
- *lecythis.*
- *perplana.*

D. *Species from the Assam Hills, North and South of Valley.*
- *a.* Labiate ..... — *atricolor.*
- *castaneo-labiata.*
- *hepatizon.*
- *lata.*
- *b.* Not labiate ..... — *decussata.*
- *lhotaensis.*
- *rubellocincta.*
- *bilineata.*
- *uda.*
- *cacharica.*
- *salmonea.*
- *godwini.*
- *terminus.*

a'. Shell globose.
b'. Strongly or microscopically striate longitudinally ..... *beata.*
munipurensis.
fragosus.

a'. Shell depressedly conoid.
b''. Smooth ..... *mahadeoensis.*
hengdanensis.
razamiensis.
lahupaensis.
hookeri.

c. Upper surface transversely plicate or ribbed .... *plicifera.*
shisha.

d. Shells not exceeding about 6 mm. (a quarter inch) in diameter. (Generic affinities often doubtful.)
a. Subglobose or subturbinate.
b. Smooth ..... *nengloensis.*
koliaensis.
roberti.
tanirensis.
b'. Longitudinally striated..... *longicauda.*
dorani.
originaria.
umbraticola.

a'. Depressed or conoidly depressed.
b''. Longitudinally striated ..... *sata.*
pacata.
rusticula.

E. *Species from Burma, Arakan, and Tenasserim.*
a. Peristome labiate ..... *consepta.*
a'. Smooth ..... *petasus.*
aspides.
b. Peristome not labiate..... *chaos.*
a''. Longitudinally (spirally) striated ..... *kumahensis.*
causia.

b'. Subglobosely depressed.
a'''. Smooth ..... *salwinensis.*
dugasti.

b''. Depressed or conoidly depressed.
b'''. Smooth ..... *subpetasus.*
noxia.
*b*⁴. Longitudinally striated ..... *nebulosa.*
notha.
hypoleuca.
spreta.
patens.

c. Shells not exceeding 6 mm.
a'. Turbinate ..... *pungi.*
b'. Depressed or conoidly depressed.
a''. Smooth ..... *molecula.*
curvilabris.
b''. Longitudinally striated ..... *perpaula.*
pauxillula.

F. *Species from Andaman and other Islands in Bay of Bengal.*
- *a.* Depressed ..... *choinix.*
  pseudochoinix.
  exul.
  stephus.
  woodmasoni.
- *b.* Depressedly conoid, more or less lenticular .... *aulopis.*
  pseudaulopis.
  fordiana.
  perinconspicua.
  battimalvensis.

G. *Species from Indian Peninsula and Ceylon.*
- *a.* Subglobosely depressed or subturbinate.
  - *a'.* Longitudinal sculpture present (microscopical). *tenuicula.*
  - *b'.* No longitudinal sculpture..... *fragilis.*
    lixa.
    hebescens.
    pedina.
    infausta.
- *b.* Depressed or conoidly depressed.
  - *a'.* Diameter not exceeding about 15 mm. ..... *umbrina.*
    nepas.
    woodiana.
    rutila.
    vallicola.
    todarum.
    perrotteti.
    prava.
    vilipensa.
- *c.* Upper surface transversely plicate or ribbed .... *peringundensis.*
- *d.* Shells not exceeding about 6 mm. ($\frac{1}{4}$ inch) in diameter.
  - *a.* Depressed or conoidly depressed.
    - *b.* Smooth ..... *perfucata.*
      tratanensis.
    - *b'.* Longitudinally striated ..... *kandiensis.*
      neherensis.
      atoma.]

Genus **PARVATELLA**, nov.

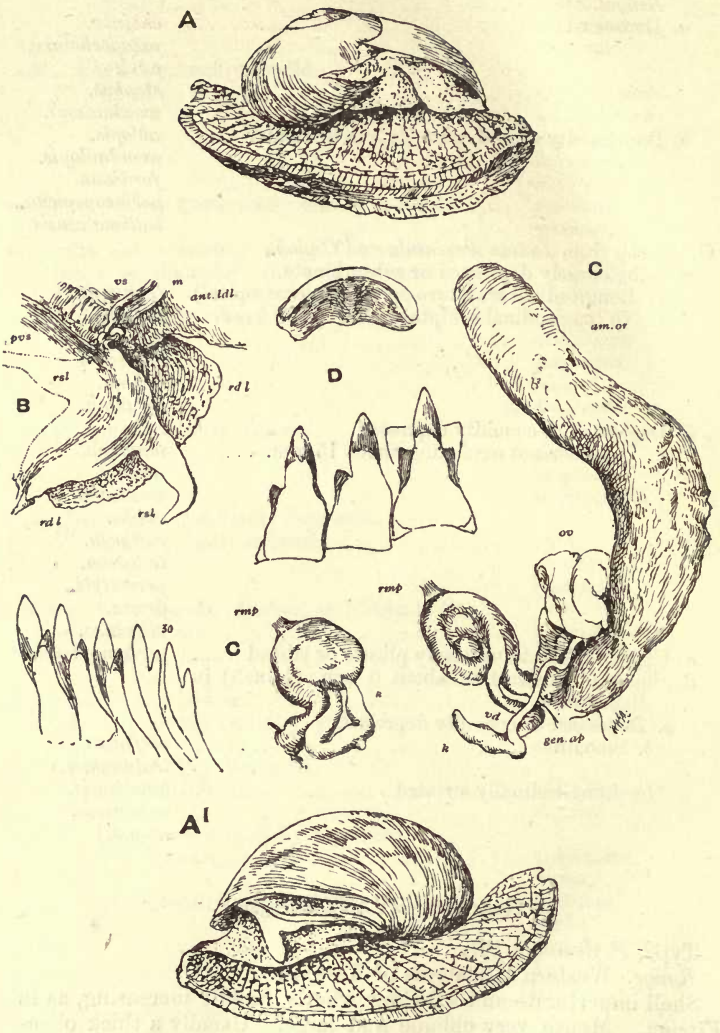
Type, *P. flemingi*, Pfr.

Range. Western Himalayas of Kashmir.

Shell imperforate and with few whorls, rapidly increasing, as in *Vitrina*. Mouth very oblique and large. Usually a thick olivaceous epidermis.

Animal with elongate tongue-shaped shell-lobes, broader than in *Macrochlamys*, and a pointed lobe above the large mucous pore at the posterior termination of the foot. The male organ has a peculiar disk-like coil, as in *Oxytes orobia* and in typical forms of *Macrochlamys*, to which the retractor muscle is attached.

This genus has the animal of *Macrochlamys*, with a *Vitrina*-like shell.



[Fig. 53.—*Parvatella flemingi.*

A, A′. Animal, drawn from specimen preserved in spirit. View of right and left sides. Natural size.
B. The right shell-lobe and right dorsal lobe. ×3.
C. Part of the genitalia: penis from both sides and amatorial organ. ×3 and 5·5.
D. Jaw and teeth of the radula. ×255.]

230. **Parvatella flemingi**, *Pfr.* (Vitrina) *P. Z. S.* 1856, p. 324; *id.* (Vitrina) *Nov. Conch.* i, p. 99, pl. 28, figs. 1–3; *id.* (Vitrina) *Mon. Hel.* iv, 1859, p. 790; v, 1868, p. 14; *Nevill* (Helicarion), *Yark. Miss., Mol.* 1878, p. 14; *id.* (Helicarion) *Hand-l.* i, 1878, p. 15; *Theobald* (Helicarion), *J. A. S. B.* 1878, 2, p. 143; *id.* (Helicarion) *op. cit.* 1881, 2, p. 45; *Godwin-Austen* (Macrochlamys), *Mol. Ind.* i. 1888, p. 212, pl. 54, figs. 1–1 *e* (animal and shell); ii, 1899, p. 133, pl. 87, figs. 2–2 *d* (spermatophore); [*Cockerell*, Pseudovitrinæ, *sect.* Helicarioninæ, *type* Macrochlamys flemingi, *Pfr. A. M. N. H.* (6) vii, 1891 (sine desc.)].

Helicarion austenianus, *Theob. J. A. S. B.* 1881, p. 45, *nec Nevill.*

Shell imperforate (sometimes apparently subperforate behind the columellar callus), depressedly globose, thin, opaque, not polished, having an olivaceous rather silky epidermis, and sculptured with plicate transverse striæ of growth, and with very close, minute, longitudinal (spiral) lines, not always easily detected; spire subconoidly convex, apex blunt, suture moderately impressed; whorls 5, convex, somewhat flattened above, the last large, rounded at periphery and swollen beneath, base smoother; aperture diagonal, lunately oval, having a pearly lustre within; peristome with the epidermis projecting beyond the shell, margins converging, arcuately dilated between upper and outer margin, columellar deeply curved, meeting penultimate whorl at an obtuse angle, reflexed above, forming a callus.

Major diam. 32, min. 24, height 17 mm. Some shells measure as much as 42 × 31 × 20.

Hab. The ranges around Mari and in Hazára; common at Tandiani (*Theobald*). The original locality was by some error given as "Scind"; but the box in the British Museum is marked "collected 10,000 feet above the sea on the Murri Hills, N. Punjab." Whether *P. flemingi* is found east of the Jhelum River is not known.

The animal differs from other *Vitrina*-like mollusca and much resembles *Macrochlamys*. The shell-lobes of the mantle are long and pointed; the mucous pore is large, with a distinct overhanging lobe. In the generative organs the male organ is attached to the retractor muscle by a disk-like coil, as in *Oxytes orobia* and most species of *Macrochlamys*. Dart-sac large, spermatheca well developed, and a rather large kalc-sac. The teeth on the radula are thus arranged: 62 . 3 . 24 . 1 . 24 . 3 . 62 (89 . 1 . 89); central tooth tricuspid, those on each side of it bicuspid; outermost laterals very minute, bicuspid.

231. **Parvatella magnifica**, *Rv.* (Vitrina) *Conch. Icon.*, 1862, Vitrina, sp. 17.

Shell depressed, thin, covered with a thin olivaceous epidermis, marked with transverse striæ of growth and with fine subobsolete spiral lines, scarcely polished above, more so beneath; spire low, convex, suture impressed; whorls 4½, flatly convex above, the last not descending, rounded at periphery and beneath; aperture oblique, lunately oval; peristome thin, margins converging, upper

arcuately dilated at junction with right margin, columellar curved, nearly vertical, slightly directed to right, where it meets penultimate whorl, and forming a small callus.

Major diam. 28½, min. 21, height 13½ mm.

Hab. Not clearly ascertained, but probably Punjab Hills. One specimen marked "Scind," which is not likely.

232. **Parvatella altivaga**, *Godwin-Austen* (Macrochlamys), *Mol. Ind.* i, 1888, p. 213, pl. 14, fig. 2.
Helicarion flemingi, *var.* altivagus, *Theob. J. A. S. B.* 1878, 2, p. 143.

Shell depressed, thin, translucent, not polished, transversely plicately marked with lines of growth, crossed by traces of fine close longitudinal (spiral) lines, olive-brownish; spire nearly or quite flat, suture very slightly impressed; whorls 5, flat above, last much broader, not descending, rounded at periphery; aperture oblique, lunately oval; peristome simple, margins converging, columellar terminating above in a reversed callus.

Major diam. 30, min. 23, height 13 mm.

Hab. Uri in the Jhelum Valley, Kashmir.

A much thinner and flatter shell than *P. flemingi*, and rather flatter than *P. magnifica*.

233. **Parvatella austeniana**, *Nevill* (Helicarion), *Yark. Miss., Mol.* 1878, p. 14, figs. 22, 24; *id. Hand-l.* i, 1878, p. 15; *Godwin-Austen, Mol. Ind.* i, 1888, p. 215, pl. 54, figs. 4, 4*a*, 4*b* (shell) (*nec Theob. J. A. S. B.* 1881, p. 45).
Macrochlamys cassida, *Godwin-Austen, Mol. Ind.* i, 1888, p. 214, pl. 54, figs. 3, 3*a* (shell).

Shell depressedly globose, moderately thin, covered with a thick dark olive epidermis, slightly polished, plicately striated transversely, without longitudinal striation; spire convexly conoid, apex obtuse, suture impressed; whorls 5, convex, the last large, but less broad than in other allied forms, descending in front, rounded at periphery, swollen beneath; aperture almost circular, lunate, higher than broad, diagonal; peristome simple, the epidermis extending slightly beyond the shell, margins converging, arcuate at upper portion of right margin, columellar lip regularly curved and meeting the penultimate whorl at an open obtuse angle, the upper portion with an appressed callus.

Major diam. 30, min. 24, height 19 mm.

Hab. Small specimens measuring 15½ mm. in major diameter were described from Sonamarg, in Kashmir, by Nevill. In Godwin-Austen's collection is a much larger shell from Uri, Jhelum Valley, of which the dimensions are given above.

[Genus **EUAUSTENIA.**

Euausteniæ, *section of* Austenia, *Cockerell, A. M. N. H.* (6) vii, 1891, p. 98 (sine desc.); *Nautilus*, xii, 1898, p. 10.

Shell differs from that of *Austenia gigas* in being more heliciform,

shelly, and thin. The animal has large leaf-like right and left shell-lobes, which in life nearly cover the whole of the shell. In the genitalia the penis has a coiled cæcum near the retractor muscle, and is thus similar to *Macrochlamys*.

Range. The Western Himalaya to Sikhim, and as far west as the Kuram Valley, Trans-Indus.]

234. **Euaustenia monticola**, *Pfr.* (Vitrina) *P. Z. S.* 1848, p. 107; *id.* (Vitrina) *Mon. Hel.* ii, 1848, p. 497; *Theobald* (Helicarion), *J. A. S. B.* 1878, 2, p. 143; *Nevill* (Helicarion), *Yark. Miss., Mol.* 1878, p. 15; *id.* (Helicarion) *Hand-l.* i, 1878, p. 15: *nec Reeve, nec H. & T., nec G.-A.*

Vitrina scutella, *Bs. A. M. N. H.* (3) iii, 1859, p. 188, partim; *Pfr. Mon. Hel.* iv, 1859, p. 498; *Rv. Conch. Icon.* fig. 13; *H. & T. C. I.* 1876, pl. 66, figs. 1–4; *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1888, p. 232, pl. 52, figs. 1–1 *e* [shell and animal of the Murree form]; *Cockerell*, Euausteniæ (*section of* Austenia), *A. M. N. H.* (6) vii, 1891, p. 98 (sine desc.); *id. Nautilus*, xii, 1898, p. 10.

? Austenia serahanensis, *Godwin-Austen, Mol. Ind.* i, 1888, p. 237, pl. 54, fig. 4.

Shell depressed, thin, pellucid, very faintly striated, smooth, polished, yellowish horny; spire flat, apex very slightly prominent, suture impressed; whorls 4, rapidly increasing, flattened above, the last not descending, rounded at periphery, moderately tumid beneath, flattened towards mouth; aperture oblique, ovately lunate; peristome thin, margins converging, the upper straight near the last whorl, then arcuate near right margin, columellar sinuate, forming a rounded obtuse angle with basal margin.

Major diam. 18, min. 13, height 7 mm.

Hab. North-west Himalayas eastward to Naini Tal.

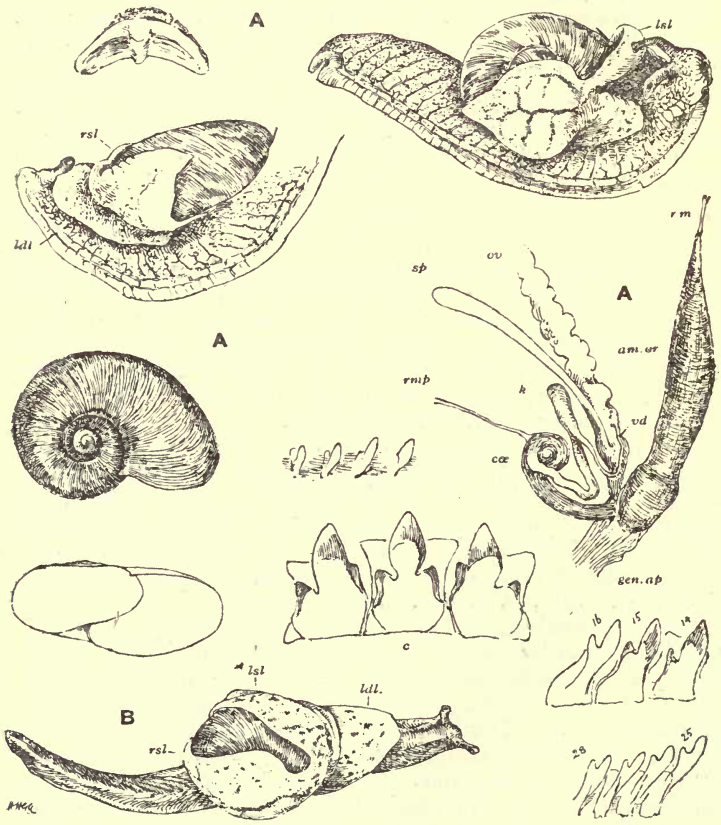
The animal (of *A. scutella* from Murree) [which I consider distinct from *monticola* of Mussoorie] has well-developed dorsal and shell-lobes to the mantle, [and these are quite plain and unmottled]. The posterior portion of the foot is very long and sharply keeled above. The odontophore bears the following teeth: 30 . 2 . 14 . 1 . 14 . 2 . 30 (46 . 1 . 46).

Pfeiffer described this shell from one of three specimens, all smooth, translucent, and depressed shells, still in the British Museum. Reeve figured a much more globose form, also in the Museum, with a raised spire and different sculpture (apparently *E. cassida*, Bs.). Hanley again figured apparently the same species, and Godwin-Austen, misled by Hutton, as pointed out by Nevill, has done the same. Theobald also recognized the true *monticola*, which he had received from Benson. *Scutella* was named from two different shells, one from Kashmir (Nasmana on the Chandrabhaga River), the other said to be from Teria Ghat in the Khasi Hills. The last is an obscure form not recognized since. The Kashmir form differs slightly from *E. monticola* in having its mouth even more lengthened, but it is doubtful whether this is constant. I regard the two as identical.

235. **Euaustenia cassida**, *Hutton, J. A. S. B.* vii, 1838, p. 214; *Pfr.* (Vitrina) *Mon. Hel.* ii, 1848, p. 497; iii, 1853, p. 2; *Rv.* (Vitrina) *Conch. Icon.*, Vitrina, fig. 10; *H. & T.* (Vitrina) *C. I.* 1876, pl. 152, figs. 2, 3; *Nev. Hand-l.* i, 1878, p. 15; *Theobald, J. A. S. B.* 1878, 2, p. 14; *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1888, p. 214, pl. 54, figs. 3, 3 *a* (shell) [is a large *Parvatella austeniana*].

Vitrina monticola, *Rv. Conch. Ic.*, Vitrina, fig. 11; *H. & T. C. I.* 1876, pl. 152, fig. 1; *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1888, p. 234, pl. 52, fig. 2.

Helicarion stoliczkanus, *Nevill, Yark. Miss., Mol.* p. 15, figs. 19–21; *Theobald, J. A. S. B.* 1881, p. 45; *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1888, p. 236, pl. 52, fig. 3 (shel).



[Fig. 54.—*Euaustenia cassida.*

A. Animal, drawn from a spirit-specimen, viewed from both the right and left side, ×2·5; in the first the left shell-lobe is shown contracted and rolled up. The genitalia, ×4·5; jaw, ×12; teeth of the radula, ×368; and shell, ×2·5.

Euaustenia stoliczkanus.

B. Animal looked at from above, ×2·5. Specimen from Naini Tal.]

Shell ovately depressed, thin, translucent, polished when young, less so when older, faintly striated, sometimes more densely, pale horny; spire convex, suture impressed; whorls $4\frac{1}{2}$, convex, the last ascending very slightly towards the peristome, rounded at periphery, tumid beneath; aperture oblique, ovately lunate; peristome thin, margins converging, upper margin straight at first near penultimate whorl, then arcuate, columellar sinuate, meeting last whorl at an obtuse angle.

Major diam. $23\frac{1}{4}$, min. 18, height 11 mm. (much larger specimens occur, one of the largest measuring $30 \times 23 \times 13$, another $26\frac{1}{2} \times 20 \times 12$).

Hab. The Western Himalayas to Kumaun.

The type of *cassida* appears to be from Simla, that of *stoliczkanus* from Almorah in Kumaun. It is possible that there are two distinguishable forms; but as *stoliczkanus* is quoted by Nevill from both Kashmir and Naini Tal, whilst the type of *cassida* is from Simla between the two, it is most likely that all are varieties, as was suggested by Nevill. The type of *stoliczkanus* measured: major diam. 22, height 13 mm.

The animal of *cassida* was described by Hutton [from Simla] as sometimes pale brownish, at others dark grey; [the shell-lobes in both are speckled and the right has a central vein-like dark streak]. "Two broad leaf-like processes, running to a point, are spread over the shell when the animal is in motion, so as entirely to conceal it, and presenting the appearance of a large grey slug with a hump-back; a fleshy anal horn, as in the genus *Nanina*." The last, of course, refers to the lobe above the mucous pore.

[Formula of a Simla specimen: 33 . 2 . 13 . 1 . 13 . 2 . 33 (48 . 1 . 48).]

236. **Euaustenia gurhwalensis**, *Godwin-Austen* (Austenia), *Mol. Ind.* ii, 1899, p. 108, pl. 91, figs. 1–1 *h* (shell, radula, &c.).

This is very similar to *E. cassida*, of which it may be a variety, but it is distinguished by fine microscopic longitudinal spiral striation crossing the plicate ridges of growth. It is more closely wound, the last whorl being narrower, and the mouth higher in proportion to its width; but as only a single specimen is available for examination, these differences may be more or less of an individual character. There are about $4\frac{1}{2}$ whorls.

Major diam. 21, min. 16, height $10\frac{1}{2}$.

Hab. Paurhi, Garhwal, North-western Himalayas.

A thick dart-sac was found, pointed at the retractor muscle. Radula like that of *Austenia gigas*. Rhachidian tooth strongly tricuspid; inner laterals bicuspid; outer laterals pointed, with an outer cusp some distance from the point; outermost teeth minute and unicuspid. [Formula: 40 . 2 . 22 . 1 . 22 . 2 . 40 (64 . 1 . 64).] [This and the sculpture make it very distinct from the two preceding species.]

237. **Euaustenia paurhiensis**, *Godwin-Austen* (Austenia), *Mol. Ind.* ii, 1899, p. 109, pl. 91, figs. 2–2 *c* (shell and animal).

Shell ovately depressed, thin, translucent, finely and irregularly striated, slightly polished, yellowish horny; spire convex, apex exserted, suture impressed; whorls 4, tumid, the last rounded at periphery and beneath; aperture oblique, subcircularly lunate; peristome very thin, upper margin nearly straight, columellar sinuate, almost vertical on the whole.

Major diam. 13, min. 10½, height 6 mm.

Hab. Paurhi, Garhwal.

The specimens appear to be young, and may belong to *E. cassida*. The radula showed the following teeth: 36 . 2 . 15 . 1 . 15 . 2 . 36 (53 . 1 . 53).

238. **Euaustenia theobaldi**, *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1888, p. 236, pl. 52, fig. 5.

Shell very similar to *E. cassida*, but distinctly more globose, aperture nearly circular, rather darker in colour.

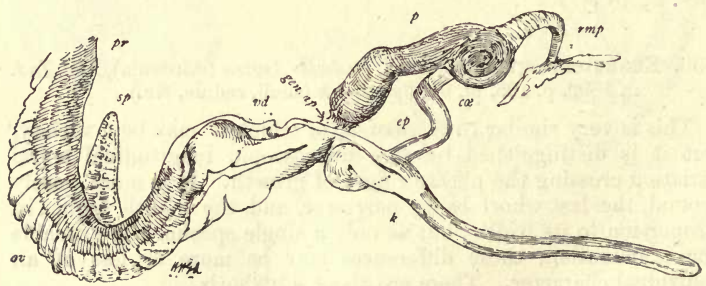
Major diam. 19, min. 15, height 10½ mm.

Hab. Chinâb Valley, above the Bichlari River in Kashmir; Dharmsala in the Kangra Valley (*Theobald*).

This may possibly be a globose variety of *E. cassida*.

Subgenus **SYAMA** *.

Type, *Macrochlamys prona*, G. Nevill.



[Fig. 55.—*Syama annandalei.*

Part of the genitalia.

cæ. Cæcum.
ep. Epiphallus.
k. Kalc-sac or flagellum.
ov. Oviduct.
pr. Prostate.
p. Male organ.
rmp. Retractor muscle of male organ.
sp. Spermatheca.
vd. Vas deferens.]

* A Sanscrit word for "black."

Animal mostly very dark coloured, with right and left shell-lobes. No amatorial organ in the genitalia; the male organ as in *Macrochlamys*.

239. **Syama splendens**, *Hutton* (Nanina), *J. A. S. B.* vii, 1, 1838, p. 215; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 73; *id. ib.* iv, 1859, p. 124; *H. & T.* (Helix) *C. I.* 1876, pl. 51, figs. 7, 10 (is another species); *Nevill*, Nanina (Bensonia), *Hand-l.* i, 1878, p. 49 (? Panjab); *id.* Nanina (Bensonia) *Yark. Miss., Mol.* 1878, p. 18; *Godwin-Austen, Mol. Ind.* i, 1883, p. 100, pl. 21, fig. 3 (sculpture), pl. 22, figs. 4, 4 *a* (shell).

Shell narrowly perforate, subdiscoidly depressed, smooth, horny, brownish tawny above, paler, sometimes whitish, beneath; radiate (transverse striation almost obsolete); concentric longitudinal impressed lines microscopic, flexuous and irregular; spire scarcely raised, suture very slightly impressed; whorls 7–8, closely wound,

Fig. 56.—*Syama splendens.*

almost flat above, the last rounded at the periphery, flatly convex below, moderately excavated around the umbilicus; aperture slightly oblique, broadly lunate; peristome simple, straight, with a white callous labiation a short distance inside, columellar margin oblique throughout, scarcely reflected at the perforation.

Major diam. 15½, min. 13½, height 6½ mm.

Hab. Western Himalayas, near Mussoorie and Simla, at elevations of 7000–10,600 ft. (*Hutton*). The type was from Mahasu, near Simla.

Animal dark verdigris-green (*Hutton*), pale grey (*G.-A.*). Small right and left shell-lobes, the left dorsal lobe divided into two. Radula like that of *M. indica*: 30 . 2 . 12 . 1 . 12 . 2 . 30 (44 . 1 . 44) (*Godwin-Austen*). [This description of the animal refers to a specimen sent to me as *splendens* by Mr. Theobald from Murree, possibly one of those referred to in Jour. Asiat. Soc. Bengal, 1878, p. 141, from Uri, Jhelum Valley, Kashmir. The shell of this species is very similar to Hanley's figure in the Conch. Indica, pl. 51, and very likely the same as the shell Nevill determined as *splendens* in 'Second Yarkand Mission,' p. 18.]

More than one species may be found in collections with this name. The shell figured by Hanley (C. I. pl. 51, figs. 7, 10) as *Helix splendens* is not Hutton's original species described by Benson. [Is quite a distinct shell, from Murree, described below (No. 245) and referred to above.] Hutton in this as in

some other instances may have used the name for different species at different times. [This is much more likely to be a mistake made by Hanley. The first specimens I collected at Mussoorie were named for me by Captain Hutton and are now in the Natural History Museum. Hutton only knew the typical Mussoorie and Simla form; he had never seen the species from Murree.]

240. **Syama prona**, *Nevill*, Nanina (Macrochlamys), *Yark. Miss., Mol.* 1878, p. 17; *Godwin-Austen, Mol. Ind.* i, 1883, p. 103 (desc. animal), pl. 22, fig. 2 (shell); ii, 1898, p. 48 (radula and jaw).
Macrochlamys masuriensis, *Godwin-Austen, Mol. Ind.* i, 1883, p. 94 (no description), pl. 21, fig. 8 (sculpture on shell).

Shell perforate, depressed, almost discoidal, rather solid, light tawny or brown, rather dull, not polished, smooth, with moderately close, fine, regular, longitudinal striæ, sometimes more or less papillate; spire almost flat, suture impressed; whorls 5–6, flatly convex above, the last whorl rather broader, rounded at the periphery, not swollen beneath; aperture nearly vertical, broadly lunate, with very frequently a thickened rib some distance inside the peristome; the latter is thin, basal margin slightly arcuate, columellar oblique, briefly and narrowly reflected.

Major diam. 16, min. 14½, height 7 mm.

Hab. North-western Himalayas.

Reported from Garhwal, Naini Tal (typical var.), Mussoorie, Simla, and Tandiani near Murree. Naini Tal specimens are small, only 12 mm. in diameter: the shell of which the dimensions are given above was from Garhwal; a Mussoorie shell measures 18 × 16 × 7 mm., and has distinctly papillate sculpture (*M. masuriensis*); smaller shells from Simla measure 14 × 12 × 6 mm. and have the sculpture not papillate.

[Much confusion has been found to be the result of starting with the idea that this species, *S. prona*, had a range extending from Naini Tal on the east and even further, from the Dafla Hills in Assam (*Nevill*) westward to Murree. When specimens from the several localities on this range are examined together and placed side by side the variation is so considerable, it is necessary to separate some of these and give them specific rank.

I have left intact all that Dr. Blanford wrote. His description of *prona* seems to be a general one; the precise locality of the shell described is not indicated, and now it is not possible to find the specimen.

The type of *S. prona* was from Naini Tal. Nevill's original description is as follows:—

"Whorls six, closely wound, the last only slightly deflected, sometimes not at all, in which case, of course, the aperture is quite vertical; spire almost or quite flat; periphery rounded; umbilicus resembling that of *Nanina petrosa*, more open than in all

the other allied species; horny-brown colour, smooth and polished above and below; margins of aperture distinctly, but slightly thickened. Type from Naini Tal: diam. 12, axis $4\frac{1}{2}$, alt. $5\frac{3}{4}$; apert. lat. 6, alt. $4\frac{3}{4}$ mm."

I am inclined to think that Nevill did not confine himself when writing the above description to a single shell; he had numerous specimens before him from various places and was at the time working out Dr. Stoliczka's collection made at Murree, finally determining a shell from that place as *prona*.

I have recently obtained from Naini Tal (*N. Annandale*) specimens of exactly the same diameter as Nevill's type. The axis is the same, viz. 4·5 mm., but the difference between that and the height of the shell is as much as 1·25 mm., clearly showing that the specimen was on spire not "almost or quite flat," which applies exactly to the Simla form, of which I have 9 examples to refer to.

Description of a shell of this species from Kichha, Naini Tal:— Shell depressedly conoid, solid, shiny, rather closely umbilicated; sculpture quite smooth, with fine transverse lines of growth; colour rich ruddy brown; spire flatly conoid, apex blunt; suture well impressed; whorls $5\frac{1}{2}$, well rounded on periphery, gradually increasing, rather closely wound; aperture lunate, nearly vertical (indication of an earlier aperture is marked by a pale band); peristome somewhat thickened, basal margin scarcely sinuate; columellar margin suboblique, very slightly reflected.

Size (largest specimen): major diam. 12·25, min. 10·8; alt. axis 5·0, height 6·75 mm.

Animal with lobe over the mucous pore, very dark grey both on foot and dorsal lobes. Both right and left shell-lobes present, but short; visceral sac darker; renal organ ochre, ochraceous on sole of foot. Generative organs: a coiled cæcum, to which is attached the retractor muscle; a very long kalc-sac; no amatorial organ.

Central teeth tricuspid; admedian teeth elongate, narrow, with cusp on outer side; the 12 first marginals bicuspid, the outer cusp low down, the next 18 aculeate, and the outer marginals very small. Formula: 30 . 2 . 10 . 1 . 10 . 2 . 30.]

[241. **Syama prona**, var. **huttoni**, *Godwin-Austen*.

Shell well perforate, depressed, almost discoid, base flat, rather strong; sculpture quite smooth; colour light tawny or light brown; spire scarcely raised above the last whorl, apex rounded; suture impressed; whorls 5, regularly increasing, somewhat closely wound, rounded on the periphery; aperture flatly lunate, nearly vertical; peristome thin, basal margin slightly sinuate; columellar margin oblique, hardly reflected.

Size: major diam. 13·75, minor 12·0; alt. axis 4·75, height 6·5 mm.

Hab. Simla (*Captain T. Hutton*): British Museum Natural History. This shell was sent home by Capt. Hutton a long time ago as *H. petrosa*, a name afterwards transferred to the species found on the hills south of the Ganges. He also considered this and the Mussoorie form the same.]

[242. **Syama promiscua**, *Godwin-Austen.*
Macrochlamys prona, *Nev.*, *Theobald, J. A. S. B.* l, pt. 2, 1881, p. 46.

Shell hardly perforate, subdiscoid, not very solid; sculpture quite smooth, lines of growth not showing; colour very pale brown, a white band behind the aperture; spire very low, only just above the level of the last whorl, apex rounded; suture shallow; whorls $5\frac{1}{2}$, regularly increasing, the last rounded on the periphery; aperture nearly vertical, broadly lunate; peristome thin, scarcely sinuate on basal margin; columellar margin very oblique, no reflexion.

Size: major diam. 12·0, min. 11·0; alt. axis 4·5 mm.

Hab. Tundiani, near Murree.

This shell may be distinguished from *S. prona* by its more discoid form, small perforation, and smooth surface. The animal is described by Theobald as "long and slender, and dark slaty above with long tentacles." His largest specimen of 6 whorls measured $15 \times 13{\cdot}4 \times 7{\cdot}8$ mm.]

[243. **Syama masuriensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 94, pl. 21, fig. 8 (sculpture on shell).
Macrochlamys prona, *id. ib.* p. 103, pl. 22, figs. 2, 2 *a* (shell).

Shell very closely umbilicated, discoidal, base flat; sculpture linear-longitudinal, each line formed by close-set papillate dots; colour pale sienna-brown, a darker conspicuous band of same colour near the aperture, progress of growth is shown by the ochraceous bands behind it at intervals; spire very depressed, apex very flattened; suture adpressed; whorls 6, regularly increasing, sides flat above, rounded on the last; aperture lunate, subvertical; peristome thin, straight, scarcely reflected and very obliquely descending on the columellar margin.

Size: major diam. 18·2, alt. axis 7·0 mm.

Hab. Mussoorie, N.W. Himalaya.

Animal (of the Mussoorie form) very black and long, a very sharp-pointed lobe over the mucous gland. Mantle slightly reflected over the margin of the peristome, with two right and left tongue-shaped expansions, which the animal expands and contracts. Animal of specimen from Paurhi in Garhwal also black. Teeth of radula 30 . 2 . 10 . 1 . 10 . 2 . 30 (or 42 . 1 . 42). Admedian teeth long, with a cusp on the outer side; the laterals bicuspid, inner point the longest; the ten or twelve outermost

very small. Jaw moderately arched, with small central projection.]

[244. **Syama annandalei**, *Godwin-Austen*. (Fig. 55, p. 152.)

Shell perforate, very depressedly conoid, thin, flat on base; sculpture quite smooth, lines of growth very fine; colour dull umber-brown; spire low, apex rather blunt; suture somewhat impressed; whorls 5¼, evenly increasing; no indication of previous apertures as in *S. prona*; aperture flatly lunate; peristome very thin; columellar margin very oblique, scarcely any reflection.

Size: major diam. 16, min. 14; alt. axis 6·5, height 8·5 mm.

Locality. Bijnore (*N. Annandale*).

Animal. On removing the shell the visceral sac is black, the renal organ white, a great contrast with it.

Genitalia as in *S. prona*. The retractor muscle is short and stout, attached to a well-coiled cæcum; the kalc-sac is very long, flagellum-like. The spermatheca elongate (fig. 55).

[Teeth of radula as in *S. prona*. Formula: +2 . 12 . 1 . 12 . 2. Marginals lost.]

[245. **Syama? theobaldi**, n. sp.

Macrochlamys splendens, *Hutton, H. & T.* (Helix) *C. I.* 1876, pl. 51, figs. 7, 10; *Theobald, J. A. S. B.* xlvii, pt. 2, 1878, p. 141; *Nevill, Yark. Miss., Mol.* 1878, p. 18.

Shell globosely conoid, narrowly umbilicated; shining surface also seen on the basal side; sculpture somewhat irregular, coarse, longitudinal striation; colour burnt-sienna; spire subconic, sides slightly convex, apex blunt; suture impressed; whorls 6, regularly increasing; aperture ovately lunate, subvertical; peristome simple, with a white callous labiation just within the aperture; columellar margin oblique.

Animal not seen.

Size: major diam. 13·25, min. 12, alt. axis 5·5 mm.

Hab. Murree, Panjab Himalaya (*W. Theobald*), Tinali (*Stoliczka*).

Theobald says:—"Colour bright chestnut, with a lustrous polish. My largest shell is not quite adult and measures 15 × 13 × 8 mm. This species occurs rather plentifully in places above Uri (Jhelum Valley), nestling under stones." In all probability Mr. Theobald sent this shell home to Mr. Hanley, and the latter figured it as *Helix splendens* in the 'Conch. Indica.' The shell agrees very well with the figure.]

Genus KHASIELLA.

Khasiella, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 129.

Type, *K. vidua*, Blf.

Range. The Eastern Himalayas, the Assam and Arakan Hills, and Northern Burma. Perhaps Tenasserim.

Shell perforate or imperforate, depressed or conoidly turbinate,

keeled or subangulate at the periphery, generally rather thin and in typical forms plicate to costulate above, smooth beneath, generally closely wound.

In the typical species, the only one of which the anatomy has been described, the right shell-lobe is present, but small; the left dorsal lobe consists of two separate parts. The sole of the foot is distinctly divided into three. The mucous gland, which is wider and overhung by a lobe, does not extend to the sole of the foot.

Generative organs. The retractor muscle of the penis is peculiarly short and solid and is attached to the flexure of a short free bent cæcum, which unites with the main organ at some distance from the origin of the latter; the *vas deferens* joins the penis close to the base of a long, blunt, knobbed kalc-sac. Spermatheca long, with a bulbous end. Amatorial organ moderately developed.

Odontophore as in *Macrochlamys*. The middle tooth of each row has a well-developed cusp on each side; the inner laterals are bicuspid, having a lateral cusp on the outer side only; the outer laterals (marginals) are bicuspid at first, then aculeate towards the margin.

Jaw with a median projection.

The name *Khasiella* was proposed for a small group of snails found in the ranges south of Assam and at the base of the Eastern Himalayas, and which had been referred for some time to *Euplecta*. The anatomy, however, is nearer to that of *Macrochlamys* than to that of *Euplecta* and *Ariophanta*.

A. *Imperforate.*

246. **Khasiella vidua**, *H. & T.* (*Blf. MSS.*) (Helix) *C. I.* 1876, pl. 130, figs. 2, 3; *Godwin-Austen*, *J. A. S. B.* 1876, 2, p. 212; *Blf.* (Euplecta) *J. A. S. B.* 1880, p. 190, pl. 2, fig. 5; *Godwin-Austen* (Khasiella), *Mol. Ind.* ii, 1899, p. 129, pl. 100 (anatomy).
? Helix climacterica, *var.*? nana, *Bs. A. M. N. H.* (3) iii, 1859, p. 392.

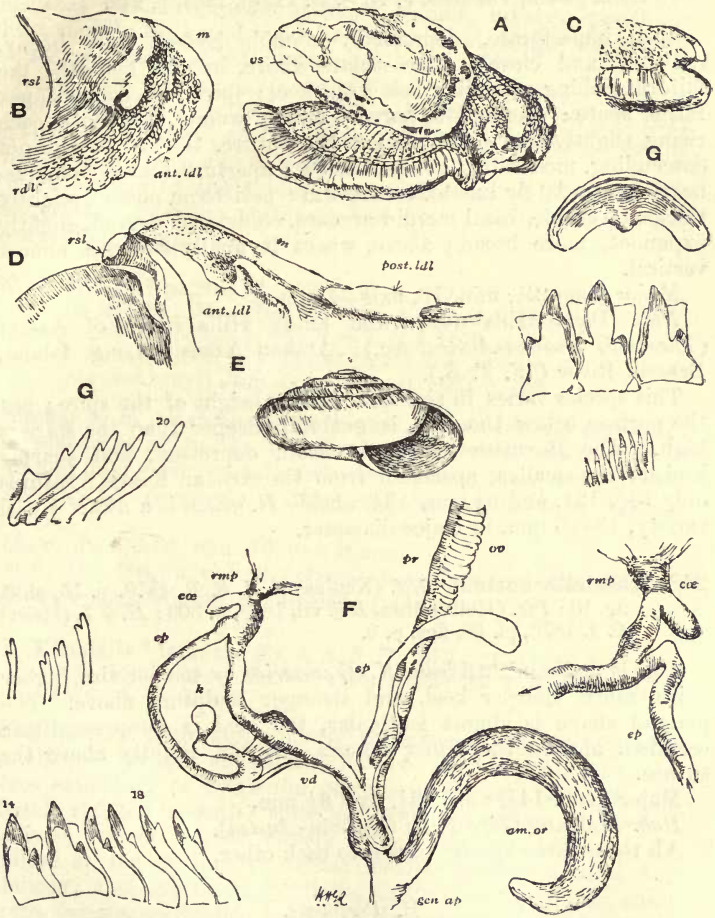
Shell imperforate, conoidly depressed to turbinate, fulvous horny, generally paler beneath, ornamented above with oblique, close, and arcuate filiform costulate striation, smooth beneath with radiating striæ; spire depressedly conoidal to conical, apex rather sharp, suture impressed; whorls 8, narrow, convex, slowly increasing in size, the last angulate or subangulate at the periphery, scarcely descending, moderately convex below; aperture oblique, lunate; peristome white, more or less obtuse, with a very slight thickening inside, the basal margin arcuate, the columellar oblique, gently curved, slightly reflected throughout, more broadly above.

Major diam. 17, min. 15½, axis 9 mm.

Hab. The Dafla Hills to north, and Gáro, Khási, and Nága Hills south of Assam (*Masters*, *Godwin-Austen*); Chittagong.

The conoidly depressed form passes into a turbinate variety, generally smaller. A specimen of this turbinate variety from the Nága Hills measures 14, 12½, and 9 mm. in its three diameters.

Nevill (Hand-l. i. p. 30) classes this as a variety of *K. climacterica*, but, despite some appearance of passage, the two forms are easily distinguished, *K. climacterica* being distinctly keeled and depressed, *K. vidua* angulate to rounded and generally subturbinate.



[Fig. 57.—*Khasiella vidua*.

A. Animal, spirit-specimen, mantle-zone removed. × 3.
B. Mantle-zone removed, showing the right and dorsal lobes. × 6.
C. Extremity of foot. × 3·25.
D. Mantle-zone, showing the right and dorsal lobes posterior dorsal lobe turned back. × 6.
E. Shell. × 2·25.
F. Generative organs. × 3·3 and 6.
G. Jaw, × 18 ; teeth of radula, × 273.]

247. **Khasiella climacterica**, *Bs.* (Helix) *J. A. S. B.* v, 1836, p. 352; *id. A. M. N. H.* (2) ii, 1848, p. 163; *id.* (3) iii, 1859, p. 392; *Pfr. Mon. Hel.* i, 1848, p. 219; *id.* iii, 1853, p. 170; *id.* vii, 1876, p. 302; *Blf. J. A. S. B.* 1865, p. 93; *Godwin-Austen, J. A. S. B.* 1876, 2, p. 312; *H. & T. C. I.* 1876, pl. 55, figs. 4, 5.
Helix geiton, *Theobald, J. A. S. B.* xxxiii, 1864, p. 242.

Shell imperforate, depressedly conoid, keeled, pale horny, radiately and closely subcostulate above, smooth beneath, the filiform ribbing extending below the keel; spire low, conical, apex rather acute; whorls 7–8, narrow, closely wound, flat above, each rising slightly above the next at the suture, the last keeled, not descending, moderately swollen below; aperture scarcely oblique, narrow, angulately lunate, securiform; peristome obtuse, slightly thickened inside, basal margin arcuate, columellar curved, slightly expanded, more broadly above, where it finally becomes almost vertical.

Major diam. 21, min. 19, axis 9½ mm.

Hab. Dafla Hills north, and Khási Hills south of Assam (*Theobald, Godwin-Austen*, &c.); Arakan Yoma; Long Island, Bassein River (*W. T. B.*).

This species varies in size and in the height of the spire; but the portion below the keel is generally deeper than the spire is high. The Burmese variety is small, depressed, and sharply keeled; the smallest specimen from the Arakan Range measures only 13½, 12½, and 6½ mm. Theobald's *H. geiton* is a dwarf Khási variety, 13–15 mm. in major diameter.

248. **Khasiella austeni**, *Blf.* (Nanina) *J. A. S. B.* 1870, p. 15, pl. 3, fig. 10; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 303; *H. & T.* (Helix) *C. I.* 1876, pl. 50, figs. 8, 9.

This is distinguished from *K. climacterica* by smaller size, higher spire, much sharper keel, and stronger sculpture above. The general shape is almost lenticular, the keel is compressed and serrated, and in the inner whorls projects slightly above the suture.

Major diam. 14½, min. 13½, axis 6½ mm.

Hab. Habiang Gáro Hills (*Godwin-Austen*).

All these three species pass into each other.

B. *Perforate.*

a. *Periphery rounded or subangulate.*

249. **Khasiella ornatissima**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 269; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 113; *H. & T.* (Helix) *C. I.* 1876, pl. 60, fig. 4; *Godwin-Austen, J. A. S. B.* 1882, 2, p. 70, pl. 5, fig. 8 (animal).
Helix anopleuris, *Theobald* (*Bs. MS.*, and H. submissa, *Bs. MS.*), *J. A. S. B* xxxiii, 1864, p. 242 (no description); *Blf. J. A. S. B.* xxxiv, 1865, p. 104; *Nevill, Hand-l.* i, 1878, p. 31.

Shell openly perforate, conoidly depressed, pale horny above, regularly and arcuately costulate, smooth, polished, with obsolete radiating striation beneath; spire low but varying somewhat in elevation, apex slightly prominent, suture impressed; whorls 7, closely wound, convex above, the last subangulate at the periphery, somewhat tumid beneath; aperture oblique, lunate; peristome white, slightly thickened inside in adults, basal margin straight or arcuate, columellar slightly expanded.

Major diam. 16½, min. 15, axis 8½ mm.

Hab. Pankabari, at base of Sikhim Himalayas (*W. T. B.*); Someysar Hills, north of Gorakpur (*Theobald*); probably foot of Himalayas in Nepal and Sikhim.

Very similar to the typical depressed form of *K. vidua*, but distinguished by being perforate and by its much stronger and more regular sculpture.

250. **Khasiella? pansa**, *Bs.* (Helix) *A. M. N. H.* (2) xviii, 1856, p. 252; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 28; *id.* v, 1868, p. 79; *Blf. J. A. S. B.* 1865, 2, p. 88; *H. & T. C. I.* 1876, pl. 56, fig. 1; *Nevill, J. A. S. B.* 1877, 2, p. 17; *id. Hand-l.* i, 1878, p. 28; *v. Mart.* (Macrochlamys) *Jour. Linn. Soc.* xxi, 1889, p. 162.

Similar to *K. ornatissima*, but thinner, more narrowly perforate, and less excavated in the umbilical region, with a rather higher spire and finer closer costulate striation above; there are 7 whorls in adults; the peristome is thin, without any trace of internal labiation.

Major diam. 16½, min. 15, axis 9 mm.

Hab. The Irrawady Valley from above Ava to below Prome; Sullivan Island, Mergui Archipelago (*Anderson*).

251. **Khasiella? falcata**, *Blf. J. A. S. B.* 1870, 2, p. 15, pl. 3, fig. 11; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 92; *H. & T.* (Helix) *C. I.* 1876, pl. 54, fig. 10.

Shell openly perforate, conoidly depressed, thin, horny, with fine, oblique, arcuate, subdistant, filiform costulation above, the riblets extending to below the periphery, smooth, polished, and radiately striated beneath; spire low, conoidal, suture impressed; whorls 6, convex, rather closely wound, the last broader, subangulate at the periphery, convex below, concave around the umbilicus; aperture slightly oblique, lunate; peristome thin, basal margin arcuate, columellar nearly vertical and produced forwards at the umbilicus.

Major diam. 13, min. 12, axis 6½ mm.

Hab. Habiang Garo Hills* (*Godwin-Austen*); Upper Burma (*Fea*).

* [This indicates the southern side of the hills intervening between the western boundary of the Khasi Hills and the independent Garo tribes. When I was there in 1866, the people were hardly under our rule, but were safe to go among; not so the Garos on their west. I cannot say whether Habiang Garo is the Khasi name for these people or whether it is a Garo term.]

A smaller thinner shell than *K. ornatissima*, with fewer whorls and more distant less distinctly costulate sculpture.

252. **Khasiella? pingoungensis**, *Godwin-Austen* (Euplecta), *P. Z. S.* 1888, p. 242.

Shell perforate, conoidly depressed, sublenticular, pale yellowish horny, arcuately and filiformly costulate above, the costulation passing over the periphery and disappearing on the lower surface, which is smooth and polished in the middle; spire low, conoid, apex obtuse, rounded, suture impressed; whorls 6½, convex, rather closely wound, the last bluntly angulate at the periphery, convex beneath; aperture oblique, angularly lunate, margins slightly converging; peristome rather obtuse, upper and basal margins arcuate, right margin sinuate, columellar margin almost vertical at its insertion and briefly expanded.

Major diam. 14, min. 13, axis 7 mm.

Hab. Pingoung, Shan Hills, Burma (*Spratt*).

b. *Periphery sharply keeled.*

253. **Khasiella serrula**, *Bs.* (Helix) *J. A. S. B.* v, 1836, p. 352; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 206; *id.* vii, 1876, p. 291; *H. & T.* (Helix) *C. I.* 1876, pl. 50, fig. 7.

Helix bensoni, *v. d. Busch, Phil. Abbild.* i, 1842–5, p. 11, pl. 1, fig. 7.

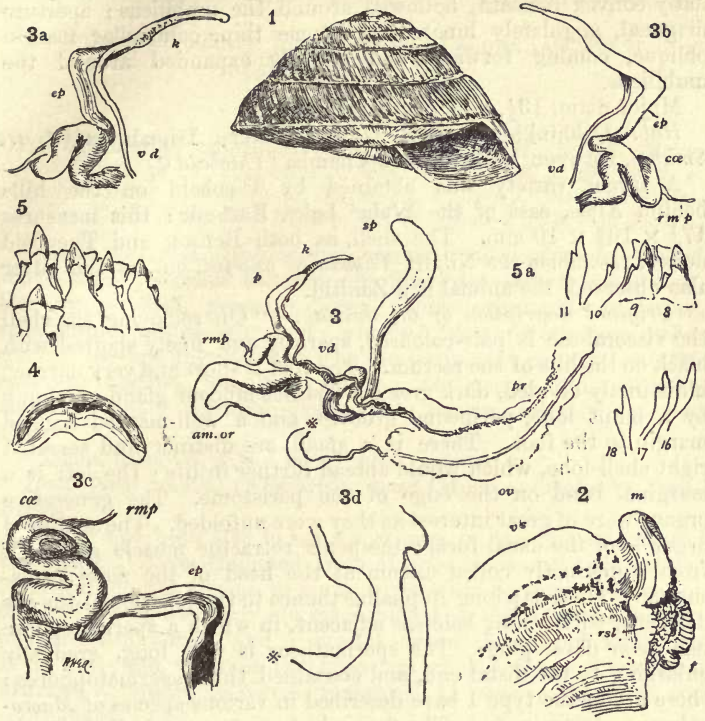
Shell openly perforate (narrowly umbilicated), depressedly subturbinate, almost lenticular, whitish horny, costulately plicate; spire low, conical, apex acute; whorls 6½–7, slightly convex above inside, each with a compressed keel, which projects above the suture, the last whorl moderately convex beneath with an acute keel, serrated by the transverse plications which pass over it to the lower surface and there pass into undulating radiate striation; aperture slightly oblique, angulately lunar; peristome thin, basal margin slightly arcuate, and together with the columellar margin faintly reflected.

Major diam. 13, min. 12, axis 7 mm.

Hab. Khási Hills (base of).

254. **Khasiella hyba**, *Bs.* (Helix) *A. M. N. H.* (3) vii, 1861, p. 83; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 181; *H. & T.* (Helix) *C. I.* 1876, pl. 30, figs. 2, 3; *Theobald* (Trochomorpha), *J. A. S. B.* 1878, 2, p. 143; *Godwin-Austen, A. M. N. H.* (7) xx, 1907, p. 55, figs. 1–5 *a*.

Shell openly and perspectively umbilicated, convexly subtrochiform, thin, obliquely, closely, and coarsely plicate, crossed by fine, close, subcostulate spiral (longitudinal) striæ above, smoother and irregularly reticulately striated on base, brownish horny; spire convexly conoid, sides convex, apex obtuse, suture linear, scarcely impressed; whorls 7–8, flatly convex above, slowly increasing, the



[Fig. 58.—*Khasiella hyba*, Bs.

1. Shell. × 4·8.
2. Side view of mantle-edge from right side, showing the obscure right shell-lobe, foot, &c. × 8.
3. Genitalia. × 4·5.

3 *a*, 3 *b*. The penis, as seen from two opposite sides, to show the coiled cæcum and position of the retractor muscle attachment, the kalc-sac or flagellum, &c. × 8.

3 *c*. A portion of same organ more enlarged, slightly pressed between two glass slips and viewed by transmitted light, to show the close-coiled cæcum; the dark portion is part of a spermatophore. × 12.

3 *d*. Terminal end and distal end of an organ not located in the genitalia and with which it may have no connection. × 12.

4. Jaw. × 24.
5. Central tooth and three admedian teeth of the radula. × 368.

5 *a*. Eighth to eleventh admedian and sixteenth to eighteenth lateral teeth.

ep. Epiphallus.
k. Kalc-sac or flagellum.
vd. Vas deferens.
cœ. Cæcum.
p. Penis.
rmp. Retractor muscle of penis.
am.or. Amatorial organ.
pr. Prostate.
rsl. Right shell-lobe.
f. Foot.
vs. Visceral sac.
ov. Oviduct.]

last not descending, sharply carinate, compressedly at the base, flatly convex beneath, hollowed around the umbilicus; aperture diagonal, angulately lunate; peristome thin, columellar margin oblique, coming forward and slightly expanded around the umbilicus.

Major diam. 13½, min. 13, height 7½ mm.

Hab. Dakhinkhund, Bari Doab, Western Himalayas (*J. D. Smithe*), between Dalhouse and Chamba (*Theobald*).

A larger variety was obtained by Theobald on the hills behind Aijas, east of the Walar Lake, Kashmir: this measures 17¼ × 16¾ × 10 mm. The shell, as both Benson and Theobald notice, resembles the Nilgiri *Thysanota guerini*, but, as the latter also observed, the animal is a Zonitid.

[*Original description of the animal*:—"On removing the shell the visceral sac is pale-coloured, sparsely and finely spotted with black on the line of the rectum. The foot is short and very narrow, indistinctly divided, dark grey; a distinct mucous gland overhung by a blunt lobe, peripodial grooves, and a well-marked fringed margin to the foot. There is a small but distinct and serrated right shell-lobe, which would spread further in life; the left is a marginal band on the edge of the peristome. The generative organs were of great interest as they were unfolded. The amatorial organ is of the usual form; the penis retractor muscle given off from a distinctly coiled cæcum at the head of the main penis-sheath. There is a long epiphallus thence to the junction of the vas deferens, with a long kalc-sac adjacent, in which a spermatophore had been developing. The spermatheca is very long, gradually enlarging to the distal end, and contained three spermatophores; these are of the type I have described in various species of *Macrochlamys*, *Austenia*, &c. The flume had no large spines, but very minute ones could be detected on the edges of it. The oviduct is peculiar, very straight up to the albumen-gland, so was the line of the prostate.

"The jaw is strong and solid, slightly arched into a central projection.

"The radula has the formula

$$\begin{matrix} 18 \,.\, 2 \,.\, 9 \,.\, 1 \,.\, 9 \,.\, 2 \,.\, 18 \\ 29 \,.\, 1 \,.\, 29 \end{matrix}$$

"The teeth are of the usual form in so many genera of the Zonitidæ, the laterals being bicuspid, with the outer cusp below the inner, becoming very small on the margin."

Compared with the type of *Khasiella*, there is (1) the same small obscure right shell-lobe; (2) the same form of foot and mucous gland; (3) the jaw and radula are precisely alike; (4) the generative organs differ in no appreciable way, merely that the short free cæcum retractoris penis of *K. vidua* becomes a close-wound coil in *K. hyba*. The shells of these two species present at first sight considerable differences, but the variation becomes less apparent

when *K. hyba* is compared with the sharply-keeled species of this genus, such as *climacterica*, Bs., *austeni*, W. T. Blf., and *serrula*, Bs.]

Of doubtful affinity, plicate or ribbed above, carinate or angulate at periphery.

a. *Perforate.*

*255. **Khasiella? chloroplax**, *Bs.* (Helix) *A. M. N. H.* (3) xv, 1865, p. 14; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 80; *H. & T.* (Helix) *C. I.* 1876, pl. 32, figs. 1, 4; *Nevill*, Nanina (Rotula), *Yark. Miss.*, *Mol.* 1878, p. 16; *id. Hand-l.* i, 1878, p. 33.

"Shell perforate, subconoidly depressed, thin, plicately striated above, slightly striated beneath, very finely decussated, translucent, scarcely polished, greenish horny; spire subconoid, depressed, apex obtuse, suture impressed; whorls 5, slowly increasing, rather convex, the last angulate above at the periphery, convex beneath; aperture oblique, angularly lunate; peristome thin, straight, margins widely separate, columellar margin scarcely reflected above.

"Diam. barely 8, axis 4 mm." (*Bs.*, Latin.)

Hab. Near Simla (*Theobald*), near Murree (*Stoliczka*, teste *Nevill*).

I have not been able to see a specimen of the Simla form, and the shells I have examined from Murree, apparently determined by Nevill, do not appear to me to agree with Benson's description or Hanley's figure; they are much higher in the spire and brown, not greenish horny, and I cannot detect decussated sculpture. It is uncertain whether the type was adult. Some shells from Murree, according to Nevill, measured 11 mm. in diameter and 6 in height.

In Hanley's figure a compressed keel is shown, the aperture is elliptically ovate, and the columellar margin of the peristome is much curved and vertical above.

This and the two next species are referred to *Bensonia* on account of the resemblance of their shells to the larger forms *B. camura* and *B. nipalensis*.

256. **Khasiella? kashmirensis**, *Nevill*, Nanina (Rotula), *Yark. Miss.*, *Mol.* 1878, p. 16, pl. figs. 13–15; *id. Hand-l.* i, 1878, p. 33.

Shell perforate, conoidly depressed, almost lenticular, carinate, thin, plicately striated above, less strongly beneath, the striation becoming obsolete towards the umbilicus, not polished, translucent, brown; spire low, conoidal, suture slightly impressed; whorls 5, rather convex, slowly increasing, the last sharply keeled, convex beneath, not excavated around the umbilicus; aperture oblique, angularly lunate (the angle disappearing in adults); peristome thin, columellar margin slightly oblique above, curved below.

Major diam. $7\frac{1}{2}$, min. $6\frac{1}{2}$, height $3\frac{3}{4}$ mm.

Hab. Sonamarg, Kashmir, abundant (*Stoliczka*).

This shell, of which I have only seen immature specimens, is described by Nevill as being smaller than *chloroplax*, with more closely wound whorls, higher spire, less acute keel, and more convex base. The form of *chloroplax* with which the comparison was made was probably that from Murree, and, as already pointed out, it is uncertain whether that form is identical with the Simla type.

*257. **Khasiella? sonamurgensis**, *Nevill*, Nanina (Microcystis), *Yark. Miss.*, *Mol.* 1878, p. 16, pl. figs. 16–18; *id. Hand-l.* i, 1878, p. 33.

"Shell small, depressed, thin, horny brown, with the suture distinct, roughly, regularly, and closely ribbed above; sculpture of a similar kind, but almost obsolete, can be traced on the base; whorls 7, closely wound, the last scarcely, if at all, broader than the previous one, more or less subangulate at the periphery; base convex, distinctly excavated round a deep narrow umbilicus (? perforation); aperture very shallow, the outer margin distinctly thickened, slightly subangulate in the middle; columella very slightly reflected, oblique, evenly rounded, without any angulation at the base, in this character resembling *N. splendens* and differing from *N. prona*. I know of no Indian species like this interesting little shell; in shape it somewhat resembles the smooth *N. woodiana*.

"Diam. 11½, alt. 5½, axis 4½, apert. lat. 5½ mm." (*Nevill.*)

Hab. Sonamarg, Kashmir (*Stoliczka*).

Dr. Stoliczka noted the presence of a mucous pore.

b. *Umbilicated.*

*258. **Khasiella? tandianensis**, *Theobald* (Trochomorpha), *J. A. S. B.* 1881, p. 46.

"Shell trochiform, keeled, narrowly umbilicated, thin, horny. Whorls 6, slowly increasing, coarsely striated transversely. Aperture but slightly oblique, quadrately lunate. Margin (of peristome) simple, near the columellar briefly reflected.

"Major diam. 9·6, height 6·7 mm." (*Theobald*, in Latin.)

Hab. Near Tandiani, Hazára, in woods, at an elevation of 8500 feet.

"The animal has a distinct overhanging lobe to the mucus-pore. The nearest ally of the shell is perhaps *T. hyba*, Bs., which is found from Chamba to Kashmir."

Genus **OXYTES.**

Oxytes, *Pfr. Zeitschr. Mal.* 1856, p. 138; *Godwin-Austen, Mol. Ind.* i, 1883, p. 123.

Type, *O. oxytes*, Bs.

Range. Eastern Himalayas, Assam Ranges, Shan States of Upper Burma, and Laos country, Siam.

Shell generally of large size, umbilicate or perforate, depressed, in general sharply keeled, smooth, striated.

As a rule there is no overhanging lobe to the mucous pore, though one is present in *O. blanfordi* and *O. pollux*. *Mantle*: right dorsal lobe triangular, well developed; left dorsal in two parts, the anterior large, the posterior very small; *left shell-lobe without any tongue-like process*, being merely a narrow ribbon reflected over the peristome; *right shell-lobe wanting*. *Generative organs*: hermaphrodite ducts very long, spermatheca elongate; male organ with a short spindle-shaped kalc-sac and having *the retractor muscle attached to a large coiled cæcum*; amatorial organ long, well developed.

[Although the shell-lobes are a typical character of many genera of Macrochlamyinæ, the coiled cæcum is perhaps a more important one, and more likely to be persistent. The origin of shell-lobes in so many distinct genera seems due to the influence of very damp atmospheric conditions in a more or less forest-clad country.]

Middle teeth of radula long, straight, without side cusps or with very small representatives of them; laterals also unicuspid or nearly so. The formula in *O. cycloplax* is 26 . 11 . 1 . 11 . 26, in *O. orobia* 27 . 15 . 1 . 15 . 27.

I. *Sharply keeled, lenticular.*

A. *Openly umbilicated.*

259. **Oxytes oxytes**, *Bs.* (Helix) *J. A. S. B.* v, 1836, p. 351; *id. A. M. N. H.* (2) v, 1850, p. 215; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 395; *id.* (Helix) iii, 1853, p. 250; *id.* (Helix) vii, 1876, p. 453; *H. & T.* (Helix) *C. I.* 1876, pl. 26, fig. 1; *Nev. Hand-l.* i, 1878, p. 47; *Godwin-Austen, J. A. S. B.* 1880, 2, p. 158, pl. 11, fig. 2 (animal); *id. Mol. Ind.* i, 1883, p. 124, pl. 30, figs. 1-3.
Nanina (Oxytes) fidelis, *Fulton, A. M. N. H.* (6) xviii, 1896, p. 100.

Shell umbilicated, depressed, obliquely striated, brownish horny, sometimes with a narrow rufous band below the keel; spire very low, apex rather pointed; whorls $5\frac{1}{2}$, flattened above, the last sharply keeled, slightly swollen beneath; aperture oblique, angularly lunate, whitish inside; peristome thin as a rule, thickened in old shells, basal margin slightly arcuate and with the columellar margin reflected; umbilicus deep, exposing all the whorls.

Major diam. 45, min. 37, height 17 mm.

Hab. The ranges south of Assam, also the Dafla Hills to the north.

Some specimens are larger; Col. Godwin-Austen has one measuring $56\frac{1}{2}$ mm. in major diameter. *O. fidelis* is a dwarf variety from the Khasi Hills, measuring $31\frac{1}{2}$, 27, $12\frac{1}{2}$ mm. It has 5 whorls and a peculiar, almost granular sculpture above and below, caused by the decussation of the striation by impressed fine spiral lines.

260. **Oxytes shanensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 128.
Helix blanfordi, *Th. J. A. S. B.* 1865, p. 275, *nec* 1859, p. 308; *id. Cat.* p. 22.

This may be a variety of *O. oxytes*, from which it is distinguished by being more compressed and lenticular, and therefore more sharply keeled, the umbilicus is slightly smaller and the sculpture finer. Only immature specimens are known; one of these measures: major diam. 28, min. 23½, height 10 mm.

Hab. Shan States, on Upper Salwin River (*Fedden*).

261. **Oxytes cycloplax**, *Bs.* (Helix) *A. M. N. H.* (2) x, 1852, p. 348; *Pfr. Mon. Hel.* iv, 1859, p. 181; *H. & T. C. I.* 1876, pl. 26, fig. 7; *Nev. Hand-l.* i, 1878, p. 48; *Godwin-Austen, Mol. Ind.* i, 1883, p. 125, pl. 31, figs. 1–8.

This is very nearly allied to *O. oxytes*; but it is smaller, less sharply keeled, with the keel becoming blunt and obsolete near the mouth; the spire is lower, the apex less pointed, the lower surface more tumid, and the umbilicus wider. As a rule, the sculpture consists of fine, rather flexuous, oblique striæ, decussated by impressed spiral lines; but there is some variation in both the present species and in *O. oxytes*. Colour brownish yellow, with a narrow rufous band round the last whorl just below the keel.

Major diam. 38, min. 32½, height 15 mm.

Hab. Sikhim, 1000–5000′.

B. *Narrowly umbilicated; umbilicus about 2 mm. across.*

262. **Oxytes blanfordi**, *Theobald* (Helix), *J. A. S. B.* xxviii. 1859, p. 308; *Pfr. Mon. Hel.* v, 1868, p. 249; *H. & T. C. I.* 1876, pl. 60, figs. 1, 2, 3; *Godwin-Austen, J. A. S. B.* 1882, 2, p. 69, pl. 5, fig. 1 (animal); *id. Mol. Ind.* i, 1883, p. 128.

Shell lenticular, sharply keeled, thin, dull chestnut, finely striated, with a minute reticulated sculpture under the microscope; spire low, conical; whorls 5½, flattened, the last much compressed near the keel, slightly convex beneath; aperture oblique, angulately lunate; peristome very thin.

Major diam. 27, min. 24, height 10 mm.

Hab. Kursiong, Sikhim, about 3000′ above the sea.

The animal is shown in Stoliczka's drawing, figured by Godwin-Austen, *l. c.*, to have a small but distinct lobe above the mucous pore.

C. *Perforate.*

263. **Oxytes castor**, *Theob.* (Helix) *J. A. S. B.* xxvii, 1858, p. 319; xxviii, 1859, p. 308; *H. & T. C. I.* 1876, pl. 26, figs. 3, 6; *Godwin-Austen, Mol. Ind.* i, 1883, p. 126.
Nanina cherraensis, *Blf. J. A. S. B.* 1870, p. 14, pl. 3, fig. 8; *Pfr. Mon. Hel.* vii, 1876, p. 131.

Shell lenticular, sharply keeled, thin, smooth, finely striated,

decussated by minute, spiral, impressed lines above and below, light ferruginous brown; spire low, conical, apex acute; whorls 5½–6, regularly increasing, flattened above, the last compressed at the keel, slightly convex beneath; aperture oblique, angularly lunate; peristome thin, the basal margin slightly arcuate.

Major diam. 35, min. 33, height 15 mm.

Hab. Khasi Hills; Cherra Punji, Nongklao, Nongkulong, and Eastern Garo Hills.

264. **Oxytes pollux,** *Theob.* (Helix) xxvii, 1858, p. 319; *Blf. J. A. S. B.* xxxix, 1870, p. 13; *Pfr. Mon. Hel.* vii, 1876, p. 132; *H. & T. C. I.* 1876, pl. 26, figs. 2, 5; *Godwin-Austen, J. A. S. B.* 1880, p. 158, pl. 11, fig. 4 (animal); *id. Mol. Ind.* i, 1883, p. 127.

Similar to *O. castor* except in colour, which is pale horny with a lower spire and less marked spiral sculpture.

Major diam. 35½, min. 32, height 13 mm.

Hab. Khasi Hills; Teria Ghat, Nongkulong; Habiang Garo Hills (*Theobald and Godwin-Austen*).

The animal is pale yellowish ochre. Eye-tentacles thick and close together at the base and long. A small lobe above the mucous pore. Radula similar to those of *O. cycloplax* and *O. orobia*, outer lateral teeth rather longer and more numerous.

As Godwin-Austen has pointed out, this is probably only a colour-variety of *O. castor*.

265. **Oxytes sylvicola,** *Blf. J. A. S. B.* 1880, p. 185; *Godwin-Austen, Mol. Ind.* i, 1883, p. 130.

Shell depressed, carinate, not very thin, covered with a thick yellowish-brown epidermis, decussated with oblique striation and spiral impressed lines; spire low, conoid; whorls 5½, nearly flat, the last moderately swollen beneath, but slightly compressed near the keel; aperture oblique, angularly lunate; peristome acute, slightly thickened inside.

Major diam. 32, min. 29, height 17 mm.

Hab. Burail Range, North Cachar, and Anghami Nága Hills.

II. *Periphery rounded, not carinate.*

266. **Oxytes orobia,** *Bs.* (Helix) *A. M. N. H.* (2) ii, 1848, p. 158; *Pfr. Mon. Hel.* iii, 1853, p. 117; vii, 1876, p. 220; *H. & T. C. I.* 1876, pl. 28, fig. 8; *Nev. Hand-l.* i, 1878, p. 48; *Godwin-Austen, J. A. S. B.* 1880, p. 157, pl. 11, figs. 1, 1 *a*; *id. Mol. Ind.* i, 1883, p. 129, pl. 30, fig. 4, pl. 32, figs. 1–5 (anatomy).

Shell perforate, depressedly globose, smooth, striated, decussated by fine, close, concentric, impressed lines, white, covered with a thick, yellowish, horny epidermis, encircled by a narrow dark rufous band below the periphery; spire depressed, convex; whorls 5–5½, slightly convex, the last rounded, sometimes subangulate at the periphery, swollen beneath; aperture ovally lunate;

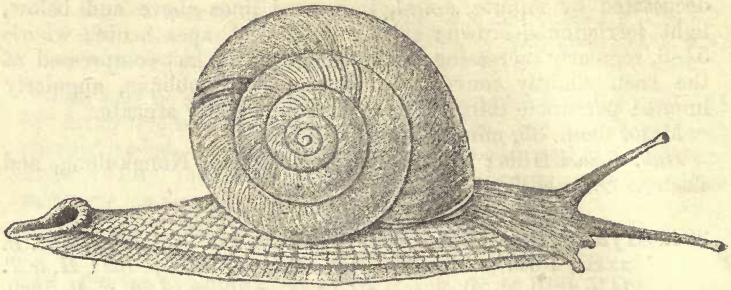
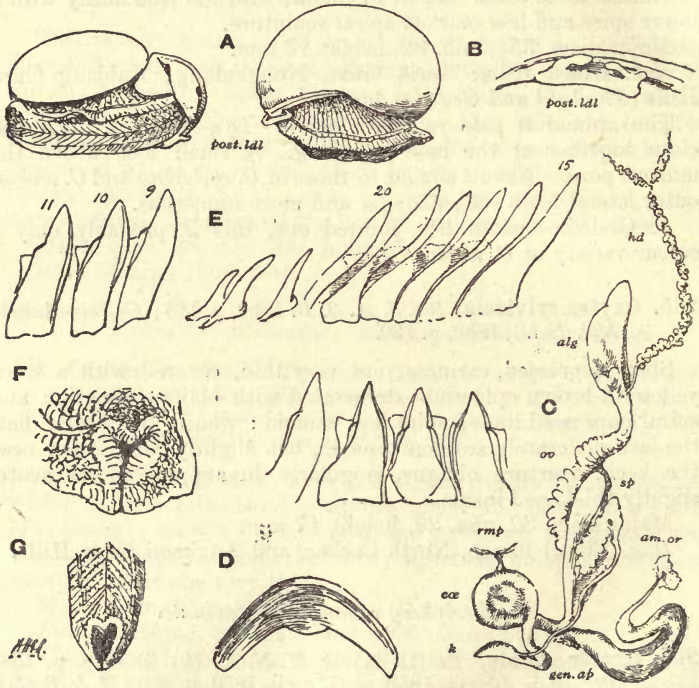


Fig. 59.—*Oxytes orobia*. (From Stoliczka's drawing.)



[Fig. 60.—*Oxytes orobia*.

A. Animal, spirit-specimen, shell removed, the right and left sides showing dorsal lobes.
B. The posterior left dorsal lobe, enlarged.
C. Genitalia.
D. Jaw.
E. Teeth of the radula. × 150.
F. Extremity of the foot, contracted in spirit, enlarged.

Oxytes oxytes.

G. Extremity of foot, drawn from life.]

peristome oblique, acute, but thickened inside, basal and columellar margins somewhat reflected.

Major diam. 37, min. 30, height 22 mm. A more depressed shell measures 34, 29, and 19 mm.

Hab. Darjeeling, Sikhim, 7000–8000′ in forest.

This species has the shell of *Bensonia*; not only is the lip thickened inside, but former lips, produced during periods of rest, often occur as in *B. monticola*. In the animal the eye-tentacles are separated by a wide interval at the base. There is no lobe above the mucous gland, which is large.

Genus **BENSONIA.**

Bensonia, *Pfr. Mal. Bl.* 1855, p. 119; *Godwin-Austen, Mol. Ind.* i, 1888, p. 246, pl. 61 (anatomy); *id.* ii, 1901, p. 115, pl. 95 (animal and anatomy).

Type, *B. monticola*, Hutt.

Range. Himalayas from Sikhim to Afghanistan. Some Chinese species are also referred to this genus, but their animals need examination.

Shell of typical forms perforate, depressed, subdiscoidal, of moderate or large size, thin; aperture lunate; peristome thin, but with a thickened callosity inside. In most of the species several lips remain, like varices, at irregular intervals on the whorls.

The animal of *Bensonia monticola* generally resembles externally that of *Oxytes* and *Ariophanta*, except that there is a broad overhanging lobe above the mucous pore. *Mantle*: right dorsal lobe simple, left divided into two; *no right shell-lobe*; *left shell-lobe simple, without tongue-shaped process.* Generative organs similar to those of *Oxytes*, *with the coiled cœcum near retractor muscle*; the dart-sac is large and long, and there is a small pointed kalc-sac. The spermatophore is a long, narrow, chitinous ribbon ending in a membranaceous sac with a hard termination. The edge of the ribbon bears bifid spikes.

The teeth of the radula in *B. monticola* differ from those of *Oxytes* and approach those of *Macrochlamys* in form. The median tooth of each row is strongly tricuspid, the inner laterals, also tricuspid, have an inner cusp near the point and an outer cusp near the base, the inner cusp is soon lost, the outer cusp disappears in about the 36th tooth, and the outer laterals become small and unicuspid, the outermost being very minute; the formula is: 72 . 19 . 1 . 19 . 72.

According to Hutton, the eggs of *B. monticola* are about the size of a mustard-seed, oval and greenish white.

I. Rounded or subangulate at periphery.

267. **Bensonia monticola**, *Hutton* (Nanina), *J. A. S. B.* vii, 1, 1838, p. 213; *H. & T. C. I.* 1876, pl. 52, fig. 3; *Theob. J. A. S. B.* 1878, p. 142; *id. ib.* 1881, p. 46; *Godwin-Austen, Mol. Ind.* i, 1888, p. 248.

Helix labiata, *Pfr. P. Z. S.* 1845, p. 65; *id. Mon. Hel.* i, 1848, p. 73; vii, 1876, p. 219; *H. & T. C. I.* 1876, pl. 27, fig. 5; *Godwin-Austin, t. c.* 1888, p. 247, pl. 61, fig. 5 (anatomy).
Nanina (Bensonia) monticola, *var.* murriensis, *Nev. Yark. Miss., Mol.* 1878, p. 17.

Shell openly perforate, depressed, moderately thin, striated, the epidermis on the inner whorls more or less distinctly minutely decussated, with oblique raised lines, tawny yellow to brown, sometimes with a broad rufous spiral band above the periphery, the lip chestnut with a broad yellowish border behind, some other chestnut and yellow stripes, indicating seasonal arrest of growth,

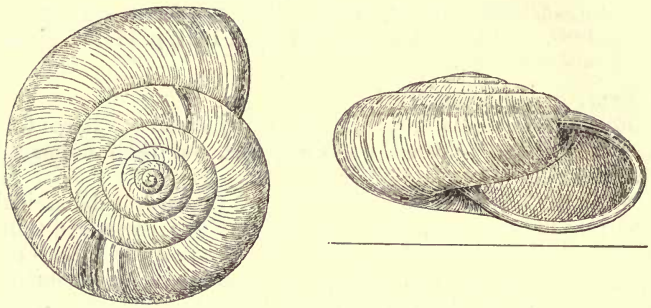


Fig. 61.—*Bensonia monticola.*

crossing the whorls at irregular intervals; spire low, conoidal; whorls 6–7, convex, the last rounded at the periphery; aperture oblique, broadly and subovately lunate; peristome acute, thickened inside with a white callosity, columellar margin reflected at the umbilicus.

Major diam. 40, min. 33, height 18 mm.

Hab. Western Himalayas from Kumaon to Hazara at elevations of about 3000–7000 feet, and locally higher; not north of the Pir Panjal in Kashmir.

The deep rufous spiral band occurs in shells otherwise pale-coloured, and is common apparently in Kumaon and Mussoorie specimens. The fine decussating markings on the inner whorls are variable, and appear to be obsolete on some Murree and Hazara shells.

268. **Bensonia angelica,** *Pfr.* (Helix) *P. Z. S.* 1856, p. 33; *id.* (Helix) *Mon. Hel.* iv, 1859, p. 123; *H. & T.* (Helix) *C. I.* 1876, pl. 86, figs. 5, 6; *Nev.* Nanina (Bensonia), *Yark. Miss., Mol.* 1878, p. 18; *Godwin-Austen, Mol. Ind.* i, 1888, p. 252.

Very near *B. monticola*, but darker in colour, without any distinct decussated sculpture, and with numerous varices, often 3 or 4 in the last whorl. The colour is olivaceous as a rule, sometimes brown. The types were small (major diam. 31, min. 27,

height 13½ mm.), but I have a shell, probably from Kashmir, measuring 45 mm. across. On the other hand, a small variety from Chamba, barely adult, measures 23½ × 20 × 11½ mm.

Hab. Range south of Kashmir; Uri (*Stoliczka*); Chamba State, 8000′.

269. **Bensonia jamuensis**, *Theob.* (Hemiplecta) *J. A. S. B.* 1878, p. 142; *Godwin-Austen*, Oxytes (Bensonia), *Mol. Ind.* i, 1888, p. 251.

This is a smaller shell than *B. monticola*, finely and flexuously striated, decussated with very fine and close spiral lines. It is depressed, thin, horny, becoming whitish beneath; whorls 6, the last rounded at the periphery, flatly convex beneath, the peristome thickened within, and the columellar margin rather broadly reflected at the umbilicus.

Major diam. 26, min. 23, height 12 mm.

Hab. Tawi Valley, between Chaneni and Udampur, Kashmir.

This is, perhaps, as Theobald has suggested, a small variety of *B. monticola*, with few or no varices. Under the microscope traces of oblique decussating raised lines on the epidermis can be made out.

270. **Bensonia theobaldiana**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1888, p. 251 (no description); *Kobelt*, Nanina (Xestina), *Mart. & Chemn. Syst. Conch.-Cab.*, Naninidæ, 1900, p. 980, pl. 254, figs. 6, 7.

Bensonia mimela, *Blf. Proc. Mal. Soc.* iv, 1901, p. 179, fig.

Shell subobtectly perforate, conoidly depressed, yellowish brown, dull above, polished below, rugately striated, finely decussated with close impressed spiral lines throughout; spire low, conoidal; whorls 7, flat, scarcely convex above, the last bluntly angulate at the periphery, convex beneath; aperture slightly oblique, subangulately lunate; peristome thin, with the usual internal callosity, which shows through the shell; former lips at irregular intervals, as in *B. monticola*.

Major diam. 27½, min. 23½, height 15 mm.

Hab. Narkanda, E.N.E. of Simla; Kulu.

Distinguished from *B. monticola* by smaller size, flatter whorls, angulate periphery, different sculpture, and less oblique mouth. A depressed form of *B. theobaldiana* occurs on the Chor, S.E. of Simla. A specimen in Col. Beddome's possession, with 6½ whorls, measures major diam. 19, axis 8½ mm.

The locality Kudin quoted by Kobelt for his *Nanina theobaldiana* is a mistake for Kulu. This and the two preceding species may be varieties of *B. monticola*.

A single specimen of a shell, apparently belonging to *Bensonia*, was obtained by Col. Beddome in the South Canara Ghats. It is doubtful if the single example obtained is adult, and without a knowledge of the animal it would be unsafe to decide as to its

generic relations, as no *Bensonia* is known from Peninsular India. The following is a short description :—

Shell perforate, depressed, dark fulvous, with a narrow chestnut stripe below the periphery, striated, finely and closely decussated; protoconch with undulating transverse striation; spire convex; whorls 4, convex above, the last angulate above the periphery, convexly swollen below; aperture oblique, roundly lunate; peristome thin, chestnut, with a white thickened lip inside.

Major diam. $19\frac{1}{2}$, min. $16\frac{1}{2}$, height $10\frac{1}{2}$ mm.

This resembles *B. theobaldiana*, but has fewer whorls and is more angulate.

271. **Bensonia convexa**, *Rv.* (Helix) *Conch. Ic.* 1852, pl. 127, fig. 762; *H. & T. C. I.* 1876, pl. 85, figs. 1–4; *Godwin-Austen, Mol. Ind.* i, 1888, p. 252.

? Helix monticola, *Pfr. Mon. Hel.* i, 1848, p. 130; *id.* vii, 1876, p. 220: *nec Hutton.*

Shell subobtectly perforate, depressed, horny, thin, striated, minutely decussated above and below by fine, impressed, spiral, close lines; spire depressedly conoid; whorls 6–$6\frac{1}{2}$, flatly convex, the last slightly compressed externally; aperture oblique, broadly lunate; peristome thin, with a broad white callous thickening inside; no remains of varices except close to the mouth.

Major diam. $16\frac{1}{2}$, min. $14\frac{1}{2}$, height 9 mm.

Hab. Kumaun, Nagtiba Range, north of Mussoorie, 9000′ (*Godwin-Austen*); Simla.

Animal light brownish green, brown near head; tentacles greenish grey; foot rather short (*Godwin-Austen*).

272. **Bensonia jacquemonti**, *v. Mart.* (Nanina) *Mal. Bl.* xvi, 1869, p. 75; *Pfr. Nov. Conch.* iv, p. 48, no. 720, pl. 118; *id. Mon. Hel.* vii, 1876, p. 220; *Nev. Yark. Miss., Mol.* 1878, p. 18; *id. Hand-l.* i, 1878, p. 49; (*var.* kurramensis) *Godwin-Austen, Mol. Ind.* ii, 1899, p. 115, pl. 95, figs. 1–1 *i* (animal and anatomy); *Kobelt*, Nanina (Xestina), *Mart. & Chemn. Syst. Conch.-Cab.*, Naninidæ, 1901, p. 997, pl. 258, figs. 7, 9.

Shell perforate, depressed, smooth, finely striated, white and porcellanic or horny, sometimes encircled by a rufous band above the periphery and inside the suture; spire very low but conoidal; whorls $5\frac{1}{2}$, slightly convex, increasing slowly, the last rounded at the periphery, moderately convex beneath; aperture slightly oblique, broadly lunate; peristome thin, thickened inside, basal margin slightly arcuate, columellar reflected a little at the perforation.

Major diam. 17, min. 15, height 10 mm.

Hab. Murree (*Stoliczka*); Salt Range, Punjab (*Theobald*).

This is probably the species figured in the atlas to Jacquemont's 'Voyage,' pl. 16, fig. 2.

273. **Bensonia wynnii,** *Blf.* (Macrochlamys) *J. A. S. B.* 1880, 2, p. 197, pl. 3, fig. 5; *Godwin-Austen, Mol. Ind.* ii, 1899, p. 118, pl. 95, figs. 2–2*b*, 3, 3*a*; *Kobelt*, Nanina (Xestina), *Mart. & Chemn. Syst. Conch.-Cab.*, Naninidæ, 1901, p. 996, pl. 258, figs. 4, 6.

Very similar to *B. jacquemonti*, but distinguished by having the mouth much more oblique, diagonal in fact, and consequently larger, with the basal margin of the peristome straight, not arcuate, and with no trace of internal thickening.

Major diam. 19, min. 17½, height 9½ mm.

The aperture measures 10½ by 9 mm.; in a specimen of *B. jacquemontii* of about the same size 10 by 7.

Hab. Murree (*Wynne*); Cherat, near Peshawar; Kuram Valley; Kandahar.

II. Shell keeled at periphery.

274. **Bensonia camura,** *Bs. A. M. N. H.* (3) iii, 1859, p. 269 (Helix); *Pfr. Mon. Hel.* v, 1868, p. 180; *H. & T. C. I.* 1876, pl. 55, fig. 2; *Nevill, Hand-l.* i, 1878, p. 30 (Nanina); ? *Godwin-Austen, J. A. S. B.* 1882, 2, p. 71, pl. 5, fig. 5, animal (Euplecta?); *id. Mol. Ind.* ii, 1907, p. 147, pl. 101, figs. 1–7 (animal & anatomy).

Shell narrowly umbilicated, conoidly depressed, sublenticular, carinate, translucent, horny, obliquely rugosely plicate, and beneath the microscope minutely obliquely rugate, the rugæ intersecting the coarse striæ at an acute angle, lower surface smoother, but still minutely obliquely decussated with raised lines; spire depressedly conoid, sides flattened, suture very little impressed; whorls 6½, scarcely convex above, the last with a compressed keel, rounded beneath; aperture oblique, angulately lunate; peristome thin, with a slight white thickened callus inside not always present, the basal margin arcuate.

Major diam. 20, min. 18½, height 10 mm.

Hab. Sikhim, 7000–12,000 feet.

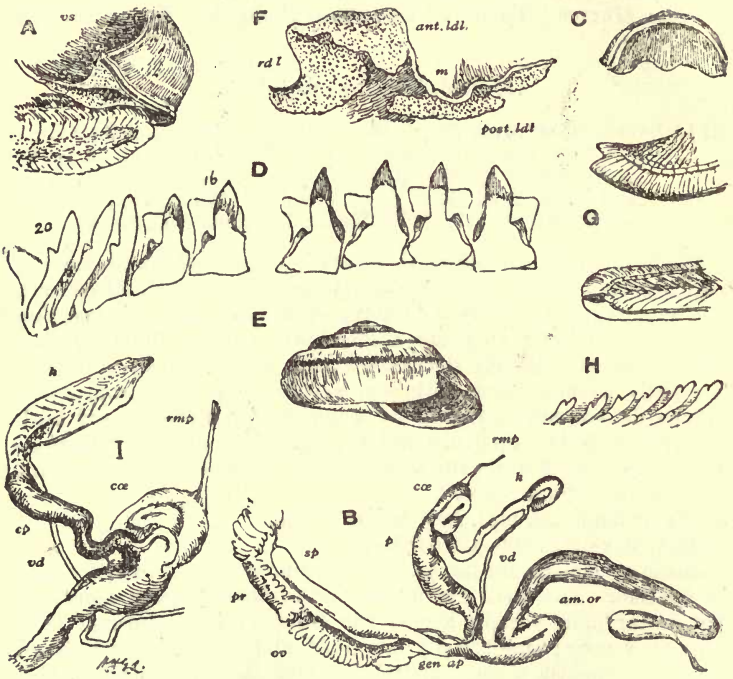
Some specimens are larger. The compressed keel in the young is file-like. The shell resembles that of *Macrochlamys tugurium*, but is far more sharply keeled and different in sculpture. The animal is grey; sole broadly margined, and has, if the published figure be correct, a very small lobe above the mucous pore: this lobe I failed to detect.

[Mr. W. Robert's collection, from Rissom Peak, Cheungtang, at the junction of the Lachen and Lachung Rivers, and Zemo Samdong, in mid-Sikhim, has cleared up much that was doubtful regarding both the generic position and range of this species. The animal (in spirit) is ochraceous; on removing the shell there is a remarkable resemblance in the markings of the integument or roof of the pulmonary cavity and renal organ to that of *Macrochlamys tugurium*, a broad patch near to rectum, and a longitudinal streak in the middle line, gradually widening and increasing in intensity backwards up to the renal organ; above this it is half black, half white; the rest of the surface is spotted and streaked with greenish black. This greenish tint pervades the whole of the

whorls of the visceral sac and gives to the shell a similar tone of coloration. There are no shell-lobes, and by this character alone, without looking at any other, the genus and species may be recognized. The dorsal lobes are very much reduced in size, having regard to the size of the animal. The foot is not divided on the sole.

The lobe over the mucous gland is very small; the peripodial fringe is very small, below the usual parallel grooves.

The generative organs. The penis has a coiled cæcum, to the side of which the retractor muscle is attached; the kalc-sac is



[Fig. 62.—*Bensonia camura.*

A. Part of the animal, showing right dorsal lobe. × 2.
B. Genitalia. × 2·4.
C. Jaw. × 9.
D. Teeth of the radula. × 276.

Bensonia wynnii.

E. Shell. Nat. size.

Bensonia jacquemonti, var. *kurramensis.*

F. Dorsal lobes. × 3.
G. Extremity of foot, side view, contracted in spirit. × 3.
" " viewed from above from life. Enlarged.
H. Outermost lateral teeth of radula. × 276.
I. Genitalia. × 6.]

short; the amatorial organ long and much twisted, and the two organs, as packed within the animal, lie respectively on the right and left sides. The spermatheca is very long. The genitalia are not at their full development: they would at the pairing-season be much more swollen.

There is a central projection to the jaw.

The radula shows the formula

$$+ 25 . 2 . 17 . 1 . 17 . 2 . 25 +$$
$$+ 44 . 1 . 44 +$$

About twelve of the outermost teeth are very minute; bicuspid teeth follow, the inner cusp being much the longest. The centre tooth is tricuspid, the admedians bicuspid, the outer small cusp situated rather lower than usual from the main point.

The absence of the shell-lobes and the long spermatheca place this species in the genus *Bensonia*. I would point out the very interesting resemblance it has to *Macrochlamys turgurium*, inhabiting the same area—externally noticeable in the coloured border to the peristome and the markings of the body seen through the shell; internally in the generative organs; showing how closely *Bensonia* approaches *Macrochlamys*.]

275. **Bensonia nepalensis**, *Blf.* (*Nevill, MS.*) *P. Z. S.* 1904, ii, p. 441, pl. 25, fig. 1; *Nevill, Hand-l.* i, 1878, no. 67, p. 27.

Shell openly perforate, conoidly depressed, sublenticular, thin, obliquely and rugosely plicate above, smoother and striated below, without any decussating lines; spire depressedly conoid, suture slightly impressed; whorls 6, convex, regularly increasing, the last not descending, keeled at the periphery, the keel becoming blunter near the aperture, tumid below; aperture oblique, roundly lunate, the margins converging; peristome thin, columellar margin regularly curved, vertical above, reflected throughout, broadly at the perforation.

Major diam. 23½, min. 21, height 12 mm.

Hab. Khatmandu, Nepal. Types in the British Museum (*Godwin-Austen*).

This shell is near *B. camura*, but is distinguished by a lower spire, smaller umbilicus, stronger sculpture, and the absence of decussating striation, and by less acute carination. The animal is not known.

[Subgenus **DALINGIA.**

Dalingia, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 149.

Type, *D. bhutanensis*, Godwin-Austen.

Range. Hitherto found only on the Sikhim-Bhutan frontier.

Shell depressedly conoid, tumid, thin and delicate; whorls few. Animal has no shell-lobes; there are three peripodial grooves (a very unusual character). The retractor muscle of the male organ given off from a large oval mass. *No amatorial organ.*]

[276. **Dalingia bhutanensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 149, pl. 102, figs. 1–6 (shell and anatomy).

Shell depressedly conoid, very narrowly umbilicated, allowing the passage of a fine bristle, thus the umbilicus is almost hidden. Sculpture, to the eye, transverse wavy lines of growth; under lens, longitudinal furrows are seen crossed by narrower ones, breaking the surface into irregular decussation. Colour rich olivaceous brown. Spire low, apex flatly conoid; suture impressed. Whorls 4, tumid, convex; aperture widely lunate, peristome thin.

Size: major diam. 20·5 mm.; alt. axis 9·5 mm., alt. body-whorl 10·5 mm.

Locality. Richila Peak, on the Sikhim-Bhutan frontier.

Animal can retire completely within the shell, and the specimens had been taken during hibernation, for the aperture was covered with a strong epiphragm, tough and transparent. It is dark-coloured. Sole of foot with a distinct central area. *There are no shell-lobes*; the left dorsal lobe is divided.

The peripodial margin is broad, *bordered above with a double row of oblong tubercles, or, in other words, there are three parallel grooves instead of the usual two.*

Generative organs. The amatorial organ is absent. The retractor muscle of the male organ is given off from the head of a large ovate swollen mass, which corresponds to the coiled mass seen in *Oxytes orobia.* There is a short flagellum or kalc-sac. The spermatheca is moderately long and consists of an ovate membranous portion situated on a lower thick muscular tube; the albumen-gland was small; the hermaphrodite-duct extremely convoluted.

Jaw with a large central projection.

The radula has this formula:—

$$\begin{matrix} 40 \,.\, 2 \,.\, 17 \,.\, 1 \,.\, 17 \,.\, 2. \, 40 \\ 59 \,.\, 1 \,.\, 59 \end{matrix}$$

The central tooth is tricuspid, the admedians also tricuspid, the inner well developed and standing higher than the outer, which is the largest. The marginals are curved, bicuspid, the outer cusp below the inner.

Of this species there were only two specimens in the B. M. collection with similar sculpture on the shell—one, an adult, from which the above description has been made, and another much younger example left in the shell; the pallial margin and markings on the visceral sac are the same in both.

The anatomy of this animal is very unlike that of those with similar shells.

It is remarkably like another in its shell-character inhabiting the vicinity of the same peak, Richila. On first sorting-out of a quart-bottle of shells from this locality I placed them together; on a second sorting I noticed considerable difference in the sculpture when this was looked at under a high power, combined with a modification in the form of the shell, of that

indefinable nature one is so often confronted with in shells of this type. Finally, on dissection, one (*richilaensis*) was found to be a *Macrochlamys* with the characteristic shell-lobes; the other (*bhutanensis*), above described, had none, and, besides, very different genitalia with no amatorial organ, thus representing two quite distinct genera.]

[Subfamily HELICARIONINÆ.

Helicarioninæ, *Godwin-Austen*, *Mol. Ind.* i, 1883, p. 146.

Typical genus, *Helicarion*, Fér.

Range. Australia, Indo-Malay, Japan, China, islands of the Pacific, and westward to Siam, Burma, and India.

This large subfamily contains many well-defined and interesting generic divisions. The similarity of the shells of many species to those of the palæarctic genus *Vitrina* led at first to their being placed by authors in that very distinct genus. The animal has broad shell-lobes more or less covering the shell, and a tail-gland is characteristic of the subfamily. The generative organs are simple, the amatorial organ absent in many. The jaw is oxygnathous. The radula ranges from one similar to that of the *Macrochlamyinæ*, with teeth 80–100 in the row, laterals bicuspid, occasionally tricuspid, to another with very numerous teeth, as many as 300–400, in the row, of simpler form, with a minute central tooth, and approaching but not so pectinated as those of the *Durgellinæ*. The animals differ widely from each other in the different genera. The shells are of a rudimentary type, thin, delicate, few-whorled, and are of little use in generic determination.]

[Genus **HELICARION.**

Helicarion, *Fér. Prod.* (*Hist. Nat.*) p. 23 (1821).
Austenia, partim, *Godwin-Austen*, *Mol. Ind.* i, 1883, p. 148.

Type, *H. cuvieri*, Fér., from Australia.

Range. Indo-Malay and Australasian Regions.

In the type genus the animal has the keel of the foot flattened. In the generative organs the amatorial organ is absent, the penis is attenuate, a long epiphallus and a very long kalc-sac. The shell of $2\frac{1}{2}$ whorls, the last much expanded and more closely wound near the protoconch than in the Indian forms of the subfamily.

In *Helicarion* various authors have placed quite a large assemblage of species, some of which, as the animals have become known, have very rightly been made the types of new genera. The shells vary in form from that of the type species *H. cuvieri*, and while all are thin, more or less membranaceous, some are even helicoid with high spire and with four or five whorls. South-African forms placed in *Helicarion*, such as *H. hudsoniæ*, Benson, depart much from the typical form. Perhaps the most distinctive group are those

possessing a solid or tubular calcareous dart, of which *Parmarion* of Java &c. may be taken as the type. None have hitherto been recorded from India, but they may be looked for in Eastern Burma. Many such genera are now known (*Parmarion*, *Microparmarion*, *Collingea*, *Wiegmannia*, *Parmunculus*, *Cryptosemelus*, *Philippinella*, *Parmella*, &c.) which might well constitute a subfamily—the *Parmarioninæ*. Genera such as *Damayantia*, also having calcareous darts, approach species of the subfamily *Durgellinæ*, the radula having very numerous and similar teeth in the row.

In *Parmarion* and allied forms, such as *Damayantia*, the development of the mantle which envelops the shell in life appears to have had its origin on the margin of the mantle-zone, and extended from its periphery equally and inwardly to the central slit in some and carried further to a complete covering in others. It has not been derived from distinct right and left shell-lobes as in *Austenia* and *Girasia*, and these terms are not therefore applicable.]

[Genus **CRYPTAUSTENIA.**

Cryptaustenia, *Cockerell, A. M. N. H.* (3) vii, 1891, p. 99 (no description: as a section of *Helicarion*); *id. Nautilus*, xii, 1898, p. 10.

Type, *C. succinea*, Reeve.

Range. Sikhim and Eastern Himalaya; Lower Bengal and to Cachar.]

Shell imperforate, thin, diaphanous, smooth, depressed; whorls 3–4½, rapidly increasing, the last large and rounded; aperture large, oblique; peristome simple, more or less membranaceous.

The animal has the shell-lobes of the mantle broad but divided from each other and almost or quite concealing the shell when fully expanded. The dorsal lobes cover much less of the back of the foot than in the latter genus. Peripodial groove and mucous pore strongly developed, a projecting lobe above the latter. *Genitalia chiefly distinguished from* Macrochlamys *by the absence of a coil for the attachment of the retractor muscle of the penis.* Radula with a tricuspid rhachidian tooth and rather numerous broad inner laterals bi- or tricuspid, together with a much smaller number of outer pointed bicuspid laterals than in typical *Girasia*, and the outer cusp of these is outside remote from the end.

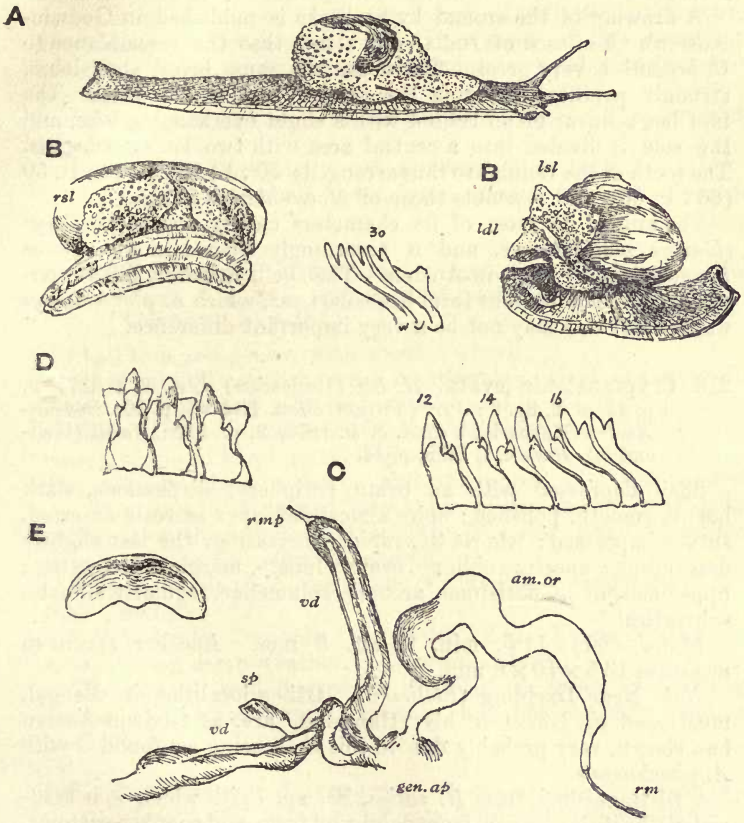
This group is at once distinguished by its shell from *Girasia* and *Austenia*. It chiefly differs from *Vitrina* by having a mucous pore, and the genitalia are quite different.

a. *Species from the Eastern Himalayas.*

277. **Cryptaustenia succinea**, *Rv.* (Vitrina) *Conch. Ic.* Vitrina, 1862, pl. ii, fig. 8; *H. & T.* (Vitrina) *C. I.* 1876, pl. 75, figs. 7, 10.
Vitrina planospira, *Bs. A. M. N. H.* (3) iii, 1859, p. 271; *Pfr. Mon. Hel.* v, 1868, p. 14; *Godwin-Austen* (Austenia), *Mol. Ind.*

i, 1883, p. 149, pl. 36, figs. 1–5 (animal and shell), pl. 38, figs. 1–1 *b* (anatomy); *id.* ii, 1899, p. 93, pl. 91, fig. 4 (dart-sac); *id.* (Eurychlamys) *t. c.* ii, p. 109; *Cockerell* (Cryptaustenia), *A. M. N. H.* (6) vii, 1891, p. 99; *id. Nautilus*, xii, 1898, p. 10: *nec* V. planospira, *Pfr.* 1853.

Shell ovately depressed, periphery roundly oval, thin, smooth, not highly polished, translucent, horny; spire convex, flat above,



[Fig. 63.—*Cryptaustenia succinea*, Rv.

A. Animal drawn from life. Nat. size.
B. Animal from a spirit-specimen: viewed from the right and left sides. × 2.
C. Genitalia. × 7.
D. Teeth of the radula. × 328.
E. Jaw. × 10·5.]

apex not exserted, suture shallow; whorls 3, rapidly increasing, the last descending very slightly near the aperture, rounded at

the periphery, convex beneath; aperture oblique, ovately lunate, margins converging, the upper curved forward, columellar deeply sinuate.

Major diam. 14, min. 11, height 6 mm. A large variety measures $19\frac{1}{2} \times 15\frac{1}{2} \times 8$ mm.

Hab. Sikhim at low elevations, Pankabari, Rangun Valley, Nampok, Rangpo near Tumlung; Damsang Peak, Daling District, Bhutan.

A drawing of the animal by Stoliczka is published in Godwin-Austen's 'Mollusca of India,' and shows that the resemblance to *C. bensoni* is very great. There are the same broad shell-lobes, strongly papillose, covering the greater part of the shell. The foot has a linear gland behind with a slight overhanging lobe, and the sole is divided into a central area with two lateral margins. The teeth of the radula are thus arranged: 50 . 1 . 14 . 1 . 14 . 1 . 50 (65 . 1 . 65), and resemble those of *Macrochlamys indica*.

The animal in most of its characters clearly resembles *Eurychlamys platychlamys*, and is accordingly placed in the genus *Eurychlamys* by Godwin-Austen. The shell, however, differs considerably. The present form has a dart-sac, which *E. platychlamys* wants; but this may not be a very important difference.

278. **Cryptaustenia ovata**, *H. Blf.* (Helicarion) *J. A. S. B* 1871, 2, p. 44, pl. 2, fig. 9; *Pfr.* (Vitrina) *Mon. Hel.* vii, p. 10; *Godwin-Austen* (Helicarion), *J. A. S. B.* 1876, 2, p. 312; *Nevill* (Helicarion), *Hand-l.* i, 1878, p. 14.

Shell depressed with an ovate periphery, diaphanous, dark horny, smooth, polished; spire almost flat, apex scarcely exserted, suture impressed; whorls $3\frac{1}{2}$, rapidly increasing, the last slightly descending; aperture oblique, ovately lunate, margins converging; upper margin of peristome arcuate, columellar regularly sinuate, subvertical.

Major diam. 11·5, min. 9, alt. 5 mm. Another specimen measures $13{\cdot}5 \times 10 \times 6$ mm.

Hab. Near Darjiling (*Stoliczka*). Other localities in Bengal, mentioned by Nevill in his 'Hand-list,' are, as Godwin-Austen has shown, very probably due to this shell being confounded with *A. panchetensis*.

"Distinguished from *H. salius*, Bs. sp. (with which it is associated), by its larger size, more depressed form, and simple peristome, not recurved at the columella. On the other hand, it is smaller, more solid, and more globular than *H. planospira*, Bs. sp. From *H. scutella*, Bs. sp., and *H. bensoni*, Pfr. sp., it differs by its greater solidity, its highly polished surface, and the less rapid increase of the last whorl. It is also smaller than the former of these species."

It is far from improbable that this shell also belongs to the genus *Durgella*.

279. **Cryptaustenia heteroconcha**, *H. Blf.* (Helicarion) *J. A. S. B.* 1871, 2, p. 45, pl. 2, figs. 8–8 *b*; *Pfr.* (Vitrina) *Mon. Hel.* vii, 1876, p. 10; *H. & T.* (Vitrina) *C. I.* 1876, pl. 152, figs. 8, 9.

"Shell much depressed, with an oval periphery, thin, diaphanous, membranaceous beneath, yellowish horny, greenish towards the aperture, polished, arcuately obsoletely striate, irregularly subcostulate towards the aperture; spire flattened, the apex scarcely exserted; whorls 3, rapidly increasing, the last dilated, scarcely descending; suture subimpressed, margined with white; aperture very oblique, oblong-ovate; anterior margin of the peristome strongly arcuate, right margin subundulate, basal margin membranaceous.

"Major diam. 17, min. 11, axis 5 mm. Height of aperture 8, breadth 11 mm.

"*Hab.* Near Darjiling." (*H. F. Blanford*, in Latin.)

The height of the shell in the figure, measured from the base, is about 8 mm.

280. **Cryptaustenia verrucosa**, *Godwin-Austen*, Helicarion (Hoplites), *J. A. S. B.* 1876, 2, p. 313, pl. 8, fig. 5.
[*Vide* fig. 64 A, p. 184.]

Shell thin and glassy, with about 4 whorls.

"Animal dull purplish grey; mantle-lobes, which can cover the entire shell, are very minutely mottled, and have a finely papillate surface. On the posterior margin are six blunt and wart-like processes, arranged three on the right and three on the left side . . . The mucous gland is larger and the upper lobe well pointed. . . . The mantle is divided into three lobes, one of rectangular outline is on the anterior left margin. The shell when the animal is in motion is very slightly exposed.

"Total length 1·25″, mantle 0·60″, mantle to extremity of foot 0·50″, tentacles 0·20″.

"*Hab.* Under Toruputu Peak at 4000 feet. Found on decaying wood during damp weather." (*Godwin-Austen.*)

The animal, well figured in the original paper, is evidently similar to *C. bensoni* and *C. succinea*, and has the same papillose shell-lobes.

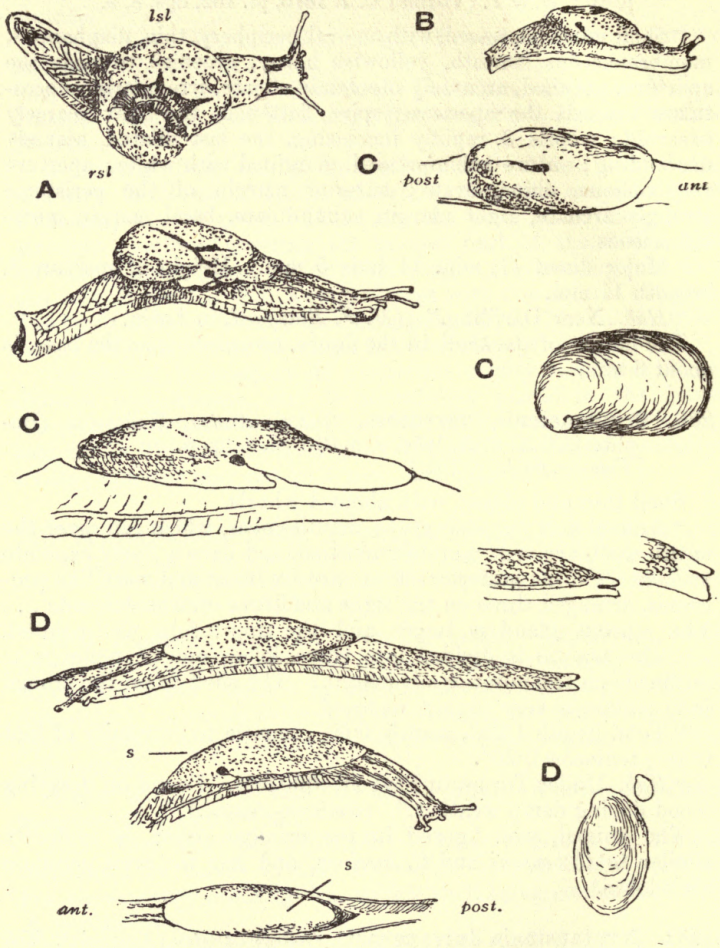
[281. **Cryptaustenia durrangensis**, *Godwin-Austen* (Austenia), *Mol. Ind.* ii, 1907, p. 172, pl. 108, figs. 5–5 *b* (shell), pl. 111, figs. 7–7 *c* (part animal and radula).

Durrang District, Assam.

Shell depressedly globose, not umbilicated; sculpture none, surface glossy, crossed transversely by fine lines of growth; colour straw-colour; spire very low, rounded, suture shallow; whorls $2\frac{1}{2}$, expansive; aperture very oval, oblique; peristome thin, narrowly edged with white, columellar margin nearly vertical.

Size: major diam. 10·5, alt. axis 3·8 mm.

Animal (from a soaked specimen). Colour olivaceous with mottlings on the foot; the membrane of the branchial cavity has



[Fig. 64.

A. *Cryptaustenia verrucosa*, viewed from above and the right side: drawn from life.
B. *Girasia cinerea*, drawn from life.
C. *Austenia nagaensis*: sketch from life of upper side of the mantle, and the right side to show the shell-lobes and shell of same.
D. *Cryptogirasia rubra*: the animal from different sides, extremity of foot enlarged, drawn from life; shell magnified and natural size.]

a margin of black on the side of the elongate kidney and the visceral sac is darkly mottled. The mucous gland linear, extremity of foot square. Shell-lobes black, the right shell-lobe broad and spreading along the side of the body-whorl; the left shell-lobe also a broad lappet and elongately triangular in shape. The male organ resembles that of *Austenia gigas*, and the amatorial organ is larger.

Jaw with a very small central projection.

Radula has the formula:

$$\begin{matrix} 70 \,.\, 2\ 15 \,.\, 1 \,.\, 15 \,.\, 2 \,.\, 70 \\ 87 \,.\, 1 \,.\, 87 \end{matrix}$$

The central tooth and the admedian teeth are of the usual form: the central tooth as drawn is malformed or broken, it is only the remnant of the usual tricuspid form; the laterals are evenly bicuspid.]

[282. **Cryptaustenia zemoensis**, *Godwin-Austen* (Austenia), *Mol. Ind.* ii, 1907, p. 171, pl. 107, figs. 4–9.

Locality. Zemo Samdong, Sikkim (*W. Robert*).

Shell rather depressedly globose, thin and membranous; sculpture none, a smooth shiny epidermis; colour ochraceous with a green tinge; spire low, rounded, apex just raised above the next whorl; whorls 3, gradually increasing, the last rounded and tumid; aperture and peristome not seen (broken below).

Its form is very similar to a species from Darjiling in Dr. W. T. Blanford's collection, figured on pl. 37, figs. 2, 2*a*, vol. i. p. 152 (Mol. Ind.), as *Austenia*? *salius*, Bs., var., a smaller or more solid shell.

Size: major diam. 11·3, alt. axis 6 mm.

The shell is of the type of *A. planospira*, but may be distinguished at once by the coil of the whorls, there being more of them. The shell is so thin and delicate, I found it impossible to detach it from the animals preserved in spirit.

Animal. Of similar form to *A. planospira*; the principal difference is noticeable in the shell-lobes, which in this species are quite smooth, whereas in *planospira* they are strongly papillate. The left shell-lobe shows a scalloped edge, with furrows running inwards towards the edge of the mantle. The left dorsal lobe is distinctly in two parts. The sides of the foot and mantle-lobes are mottled, but not strongly, and one specimen shows this only slightly on the shell-lobes. The sole of the foot is divided, but the segmental lines on the side do not extend across the central portion as in *A. gigas* and other species. The fringe of the foot is paler than the rest of the animal, from the peripodial groove to the edge of the foot.

The generative organs are interesting, because in the penis *there is a solid coiled rounded mass at the main bend, from which the retractor muscle is given off*, and in this respect this species

shows an approach to *Macrochlamys*; yet again in this connection there is also a well-developed kalc-sac or flagellum at the point of junction of the vas deferens. The amatorial organ is short and blunt at the outer end; in this respect it is like that seen in the genitalia of *Austenia planospira*. The spermatheca is apparently long, only a part, perhaps half, is left, a portion having been broken off in dissection.

The jaw was arched, solid, and with a strong central projection.

The radula has the formula:

$$\begin{matrix} 25 \cdot 16 \cdot 1 \cdot 16 \cdot 25 \\ 41 \cdot 1 \cdot 41 \end{matrix}$$

The teeth are similar in form to those of *C. bensoni* of Calcutta, the outer cusp lying low down, up to the extreme marginals.]

[283. **Cryptaustenia silcharensis**, *Godwin-Austen* (Austenia), *Mol. Ind.* ii, 1907, p. 170, pl. 107, figs. 1–3 *c* (shell, animal, and anatomy).

Locality. Near Silchar, Cachar (*F. Ede*).

Shell. The description of *C. bensoni* will apply generally. It is bright and shining, of a straw-colour. Three whorls, these are flatter above than in that species, making the aperture wider horizontally to the axis; viewed from above, the last whorl spreads and widens outwards as it nears the aperture.

Size: maj. diam. 0·95, alt. axis 0·35 mm.

Animal. Preserved in spirit is pale vinous, greyer on the shell-lobes; on the side of the foot, just above the peripodial groove, are a series of isolated dark blotches. The foot is long behind, narrow compressed at the sides, and terminating in a long hooked point overhanging the narrow slit of the mucous gland. The sole is very distinctly divided. The peripodial groove and margin not so distinctly marked as in some species. The right and left shell-lobes are remarkably developed, particularly the former; broad and expanding, in life evidently covering the whole shell, they have a beautiful papillate surface. The length of this specimen (contracted) is 2·25 mm.

Genitalia. The amatorial organ is long and cylindrical, tapering gradually to the retractor muscle. The penis is bent sharply where the long retractor muscle is given off, then there is a short swollen part where the spermatophore would be formed, and this narrows to the vas deferens. The spermatheca is moderately long.

The jaw has a central projection.

The radula has the formula:

$$\begin{matrix} 52 \cdot 2 \cdot 10 \cdot 1 \cdot 10 \cdot 2 \cdot 52 \\ 64 \cdot 1 \cdot 64 \end{matrix}$$

Similar to that of *C. bensoni*, and the teeth are of the same tricuspid type shown in plate 38, fig. 2, vol. i, Mol. Ind.]

284. **Cryptaustenia globosa**, *Godwin-Austen*, Helix (Nanina), *J. A. S. B.* 1876, 2, p. 312; *id.* (Austenia) *Mol. Ind.* i, p. 153, pl. 37, figs. 5–5 *b* (shell).

Shell depressedly subglobose, thin, transparent glossy, scarcely striated, whitish horny; spire slightly raised, suture impressed; whorls $3\frac{1}{2}$, convex, the last not descending above, broadly rounded at periphery, expanded below; aperture oblique, lunately circular; margins converging, columellar roundly sinuate.

Major diam. $9\frac{1}{2}$, min. $7\frac{1}{2}$, height $5\frac{1}{2}$ mm.

Hab. Summit of Toruputu Peak, Dafla Hills, north of Assam (*Godwin-Austen*).

More globose and with a rounder mouth than the allied forms. Animal dark grey, with the lobe over the gland much hooked.

b. *Species from Bengal.*

285. **Cryptaustenia bensoni**, *Pfr.* (Vitrina) *P. Z. S.* 1848, p. 107; *id.* (Vitrina) *Mon. Hel.* ii, 1848, p. 497; *H. & T.* (Vitrina) *C. I.* 1876, pl. 65, figs. 1–4; *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1883, p. 150, pl. 36, figs. 6, 7 (shell and animal extended).
Austenia bensoni, *var.* sylhetensis, *Godwin-Austen, l. c.* pl. 38, fig. 3.

Shell depressed, thin, faintly striated, polished, translucent, pale horny; spire scarcely raised, obtuse, suture very slightly impressed; whorls $3\frac{1}{2}$, slightly convex, the last scarcely depressed; aperture oblique, lunately subovate; peristome simple, thin, the margins converging, the upper slightly curved forward, the columellar sharply curved upwards, inclined forward beyond the vertical.

Major diam. 10, min. 8, depth $5\frac{1}{2}$ mm. (The original type measured $12 \times 9\frac{1}{2} \times 6$ mm.)

Hab. Bengal, Calcutta, Jessore, Chandanagore. Not rare in the Botanic Garden, Calcutta.

Animal dull greenish grey or very pale olive with some large irregular blotches; sole of foot white in the middle, dusky on each side. The shell-lobes of the mantle almost or entirely cover the shell and are rough, being covered with small papillæ. The teeth on the radula are: 45 . 3 . 12 . 1 . 12 . 3 . 45 (60 . 1 . 60); all the 15 inner laterals are tricuspid, the outer bicuspid and pointed, the second outer cusp not being near the end.

Godwin-Austen has described as a variety *C. bensoni*, var. *sylhetensis*, from a wood on the banks of the Soorma River in Sylhet, between Atgaon and Chatak. Although the shell does not differ greatly, the radula has 64 . 2 . 14 . 1 . 14 . 2 . 64 (80 . 1 . 80) teeth, the outermost of which show signs of pectination, as in *Durgella*. The animal is light yellowish green and creeps about with the caudal termination of the foot raised in the air.

286. **Cryptaustenia panchetensis**, *Godwin-Austin* (Austenia), *Mol. Ind.* i, 1883, p. 153, pl. 37, figs. 3–3 *b* (shell).

Shell very similar to *C. bensoni*, but the shell is thicker, and the last whorl descends near the aperture.

Major diam. 10½, min. 8, height 5 mm.

Hab. Panchet Hill, W. of Raniganj, Bengal (*W. T. B.*). Godwin-Austen suggests that specimens from Rajmahal, Sikrigali, and Patna in Bengal, referred by Nevill in his 'Hand-list' to *A. ovata*, may be the same as the Panchet shell.

[Genus **EURYCHLAMYS.**

Eurychlamys, *Godwin-Austen, Proc. Malacolog. Soc.* vol. iii, July 1899, p. 250 (no description); *id. Mol. Ind.* ii, 1899, p. 90.

Type, *E. platychlamys*, W. T. Blf.

Range. Southern India and Ceylon.

Original description:—"The shell-lobes are elongate and broad, more or less papillate, enveloping the shell. The left dorsal is divided into two lobes, the posterior one narrow. Lobe above mucous gland overhanging. Foot long and narrow behind, the sole with a simple straight sheath, the retractor muscle attached at the end, and above a small bulbous enlargement where the vas deferens joins. The amatorial organ is absent. The jaw has a central projection. The central tooth is tricuspid, the admedian bicuspid, the laterals evenly bicuspid (from 70 to 60 on each side)."]

287. **Eurychlamys platychlamys**, *Blf. J. A. S. B.* 1880, 2, p. 195, pl. 2, fig. 9; *Godwin-Austen* (Eurychlamys), *Mol. Ind.* ii, 1899, p. 90, pl. 84, figs. 1–1 *e* (animal and anatomy).

Nanina (Microcystina) perrotteti, *Peile, Jour. Bomb. N. H. Soc.* xi, p. 134 (1897): *nec Pfeiffer.*

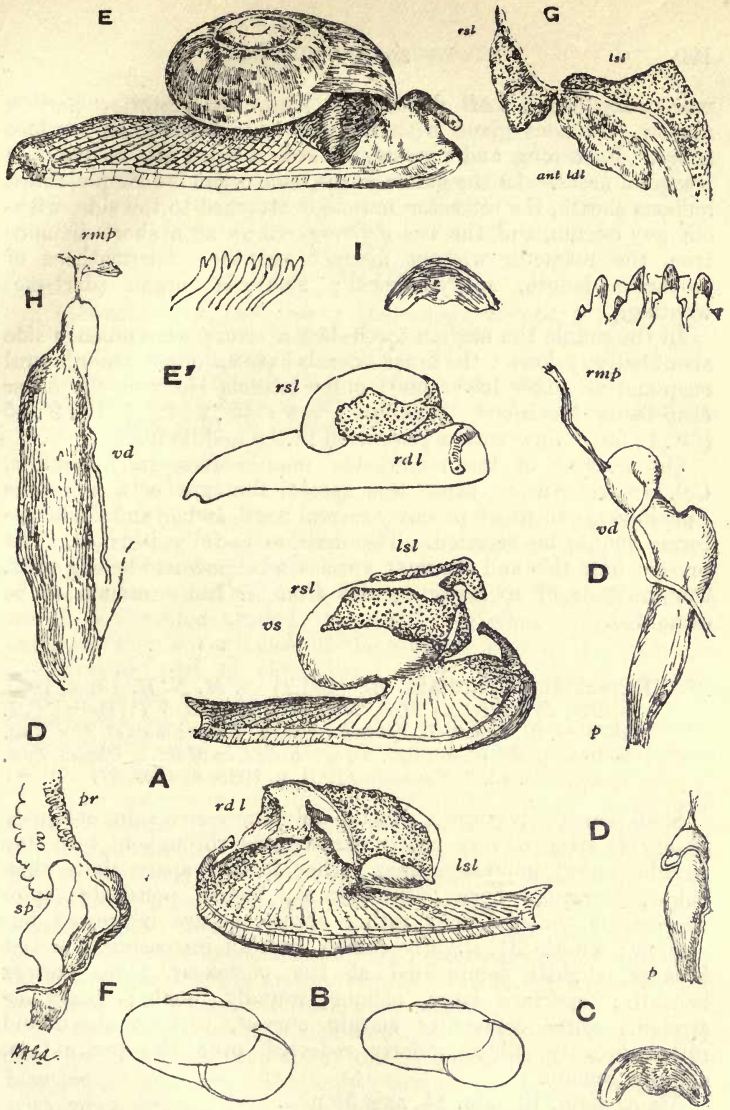
Shell openly perforate, conoidly depressed, thin, smooth, polished, translucent, fulvous horny; spire low, convexly conoidal, apex obtuse, suture scarcely impressed, almost flat; whorls 5, slightly convex, the last rounded at the periphery, convex beneath; aperture oblique, subovately lunate; peristome thin, outer margin sinuate, basal straight, columellar oblique, slightly expanded throughout, more broadly above.

Major diam. 11, min. 9½, height 5½ mm. (a large specimen measures 14 × 12 × 6½ mm.).

Hab. Bombay and neighbourhood.

A variety larger and with a lower spire occurs at Champanir, near Broach. A shell measures 16 × 13½ × 7 mm.; others are even larger.

The animal is dark grey and has remarkably broad shell-lobes, which cover a great part of the spire, sometimes nearly the whole,



[Fig. 65.—*Eurychlamys platychlamys.*

A. Animal with shell removed, viewed from both the right and left sides, showing the shell- and dorsal lobes. × 4·5.
B. Shell. × 2·4. C. Jaw. × 12.
D. Different parts of the genitalia. × 4·5 and × 12.

Eurychlamys regulata.

E. Animal (spirit-specimen), seen from right side. × 3·4. Right shell-lobe turned down, showing inside surface.
E′. Ditto. × 2·5. Showing position of right shell-lobe in life.
F. Shell. × 2·4. G. Lobes of the mantle. × 3.
H. The penis. × 8.
I. Jaw and teeth of the radula. × 12 and × 368.]

when extended. Left dorsal lobe bifid, the posterior portion narrow. Mucous gland with a small rounded overhanging lobe above. Foot long and narrow, the sole divided into median and marginal areas. In the genitalia the male organ is a simple, short, bulbous sheath, the retractor muscle is attached to the side, without any cæcum, and the *vas deferens* enters at a short distance from the retractor without distinct kalc-sac. Spermatheca of moderate length, subcylindrical; amatorial organ (dart-sac) wanting.

In the radula the median tooth has a strong cusp on each side about halfway down; the inner laterals have an upper inner lateral cusp and an outer lower one; outer laterals bicuspid, the outer cusp below the inner. Teeth in a row: 45 . 2 . 12 . 1 . 12 . 2 . 45 (59 . 1 . 59). Jaw with a projection in the middle inside.

On account of the remarkable mantle-lobes and genitalia, Col. Godwin-Austen made this species the type of a subgenus *Eurychlamys*, to which probably several South Indian and Ceylonese forms should be referred. The division is fully justified. [At present only this and the next species are known to belong to it. The animals of so many species from S. India remain to be examined.]

288. **Eurychlamys regulata**, *Bs.* (Helix) *A. M. N. H.* (3) v, 1860, p. 383; *Pfr.* (Helix) *Mon. Hel.* iv. p. 125; *H. & T.* (Helix) *C. I.* 1876, pl. 31, figs. 5, 6; *Godwin-Austen* (Eurychlamys), *Mol. Ind.* ii, 1899, p. 92, pl. 84, figs. 2 *a–g*; *Kobelt, in Mart. & Chemn. Syst. Conch.-Cab.* ed. 2, Naninidæ, 1901, p. 1028, figs. 26, 27.

Shell scarcely perforate, subglobosely depressed, thin, obliquely obsoletely striated, very neatly ornamented throughout with fine parallel spiral impressed lines, rather further apart above than below, brownish horny, translucent, highly polished; spire depressedly conoidal, apex rather obtuse, suture impressed, but shallow; whorls 3½, slightly convex, rapidly increasing, the last broader, slightly compressed at the periphery, more convex beneath; aperture large, oblique, roundly lunate; peristome straight, acute, columellar margin curved, vertical above and rather broadly subtriangularly reflected over the perforation, margins remote.

Major diam. 10, min. 8½, axis 5½ mm.

Hab. Ceylon, Kaluganga in East Matelle, Katukellekande (*Layard*), and Badulla (*Collett*).

Animal very similar to that of *E. platychlamys*: foot long behind the shell, lobe over the mucous gland elongate; shell-lobes broad, almost or completely covering the shell when extended. Penis a simple long sheath without cæcum or other appendage, the *vas deferens* joining it very near the retractor muscle. No dart-sac. Teeth on radula thus arranged: 55 . 2 . 12 . 1 . 12 . 2 . 55 (69 . 1 . 69). Median tooth tricuspid; lateral cusps basal, inner laterals bicuspid

with one cusp on the outer side; outer laterals with two even terminal cusps as usual in *Macrochlamys*.

[To this genus may belong such forms as *umbrina*, *nepas*, *woodiana*, &c., provisionally placed in *Macrochlamys*.]

Genus **AUSTENIA**.

Austenia, *Nevill* (*subgenus of* Helicarion), *Hand-l.* i, 1878, p. 16; *Godwin-Austen, P. Z. S.* 1880, pp. 294, 298; *id. Mol. Ind.* i, 1883, p. 148, 1888, p. 228.
Girasia, partim, *Godwin-Austen, Mol. Ind.* i, 1888, p. 216.
Cryptibycus, *Cockerell, A. M. N. H.* (3) vii, 1891, p. 99; *id. Nautilus*, xii, 1898, p. 10 (no description).

Type, *A. gigas*, Bs.

Range. The Himalaya, Assam, and Burma.

Shell imperforate, ovate, of one to two whorls, very thin as a rule, often glassy; aperture very large, more or less ovate; peristome thin, almost membranaceous.

Animal large, not retractile within the shell. The lobes of the mantle are united around the shell, and when the animal is extended they cover much of the anterior part of the foot and the greater part of the shell. Each shell-lobe is roundly expanded upon the shell, not elongate as in *Macrochlamys*. In some forms, as *A. magnifica*, the shell is nearly or quite concealed by the mantle-lobes, as in *Girasia*, while in the type a considerable portion remains exposed.

Hinder extremity of foot long, sharply carinate above and truncate behind by a large linear mucous pore, above which there is sometimes an overhanging lobe. Peripodial groove very distinct. Sole of the foot divided into three longitudinal areas.

Genital aperture, as usual, behind the outer base of the right tentacle. The details of the generative organs much resemble those of *Macrochlamys*, except that near the retractor muscle of the male organ there is neither cæcum nor coil. A large dart-sac is present and a long cylindrical spermatheca.

In the radula, which much resembles that of *Macrochlamys*, the rhachidian is tricuspid, and the admedian teeth are broad and bicuspid or tricuspid. The outer laterals are long and pointed, with an additional cusp low down on the outer margin, and which disappears on the outermost teeth. This differs from the form of the outer marginals in *Girasia*.

The genus *Austenia* is intermediate between *Macrochlamys* and *Girasia* and distinguished from all by its ovate ear-shaped shell. It is less slug-like than *Girasia*, its shell being well formed and, as a rule, less covered by the mantle. It is represented in the Indian Peninsula by the genus *Pseudaustenia*, which has a similar shell, but several differences in the animal.

289. **Austenia gigas**, *Bs.* (Vitrina) *J. A. S. B.* v, 1836, p. 350; ? *Pfr.* (Vitrina) *Mon. Hel.* ii, 1848, p. 496; *Blf.* (Vitrina) *J. A. S. B.* xxxiv, 2, 1865, p. 95; *Godwin-Austen* (Helicarion), *J. A. S. B.* 1875, p. 6, pl. 3 (animal extended); *H. & T.* (Vitrina) *C. I.* 1876, p. 29, pl. 66, figs. 2, 3; *Nevill*, Helicarion (Austenia), *Hand-l.* i, 1878, p. 16; *Godwin-Austen*, *P. Z. S.* 1880, p. 294, pls. 24, 25, 26, 27; *id. Mol. Ind.* i, 1883, p. 148, 1888, p. 228, pl. 55, figs. 3–4 *b* (shell and animal), pl. 60, figs. 1, 1 *a* (animal extended), pl. 62, fig. 8 (radula); vol. ii, 1899, pls. 89, 90 (genitalia).

Shell thin, polished, subovately depressed, faintly striated, olivaceous horny; spire small, flat, projecting beyond the peristome,

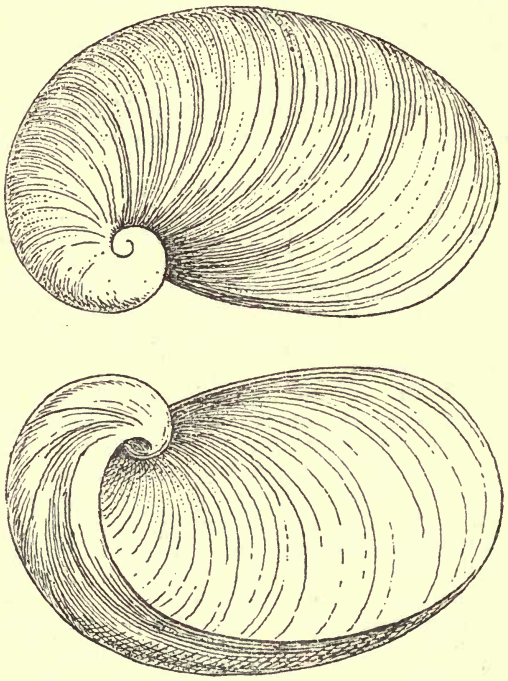


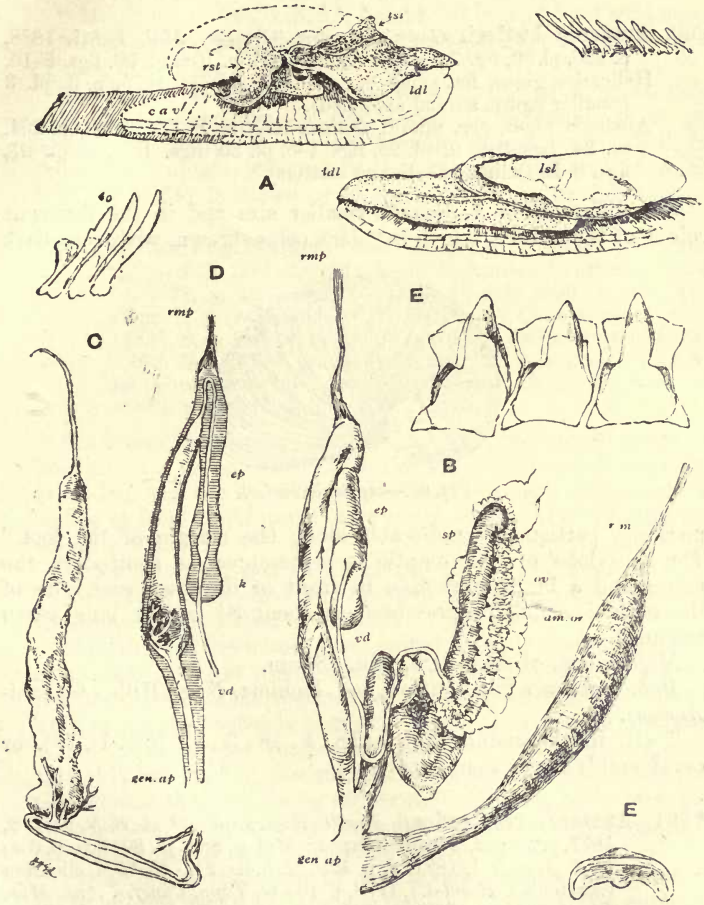
Fig. 66.—*Austenia gigas*, Bs.

suture impressed; whorls about 2, very rapidly increasing, the last depressed above, occupying the greater part of the shell; aperture very large and oblique, ovate, the margins nearly meeting, the columellar strongly arcuate.

Major diam. 30, min. 17, alt. 10 mm. A large specimen measures $40 \times 25 \times 12$ mm.

Hab. Khasi Hills, common about Teria Ghat. Allied species in Arakan Range, west of Prome, and Kyouk Phyu and Ramri Island.

The length of the animal, when fully extended, is about 6 inches. A considerable portion of the shell remains exposed (this doubtless varies in extent). The teeth of the radula are thus arranged: 69 . 3 . 22 . 1 . 22 . 3 . 69 (94 . 1 . 94); the number of broad inner lateral (admedian) teeth being very large. The rhachidian tooth is bluntly tricuspid, the next 6 on each side have



[Fig. 67.—*Austenia gigas.*

A. Animal from a spirit-specimen, viewed from both the right and left sides, showing shell- and dorsal lobes; in the former, *cav.* is the posterior end of the cavity in the foot occupied by the internal organs.
B. Genitalia: the spermatheca filled with spermatophores.
C. A spermatophore taken from the spermatheca.
D. Penis, showing spermatophore in process of formation.
E. Jaw and teeth of the radula.]

only a blunt outer cusp, afterwards an inner cusp becomes visible. The outer laterals bicuspid, with a long point and an additional cusp low down on the outer side; the extreme marginals are simple unicuspid teeth.

The general colour of the animal as represented in the figures is an umber-brown, the furrows on the upper surface being darker.

290. **Austenia butleri,** *Godwin-Austen* (Girasia), *Mol. Ind.* i, 1888, p. 226, pl. 60, fig. 7; *id. op. cit.* ii, 1899, p. 108, pl. 90, figs. 5–10.
Helicarion gigas, *Bs.*, small var., *J. A. S. B.* xliv, 1875, p. 6, pl. 3 (smaller figure, animal extended).
Austenia gigas, *var.* minor, *Godwin-Austen*, *P. Z. S.* 1880, p. 294, pl. 24, figs. 3–6, 9, pl. 25, figs. 1–5, pl. 26, figs. 1, 5, 8, pl. 27, figs. 8–10 (animal, shell, and anatomy).

This differs from *A. gigas* in smaller size and in the different colour of the animal, which is "dark ochre-brown, with very dark

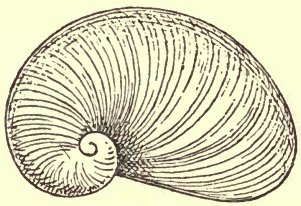


Fig. 68.—*Austenia butleri.*

marking, particularly noticeable along the margin of the foot." The neck-lobe of the mantle is represented as spotted in the figure and a broad dark line in front of it, down each side of the neck. Animal represented as about $3\frac{1}{2}$ inches long when extended.

Major diam. of shell 21·5, min. 18 mm.

Hab. Between Samuguting and Kohima, Naga Hills (*Godwin-Austen*).

Teeth in the radula 32 . 3 . 18 . 1 . 18 . 3 . 32 (53 . 1 . 53), or considerably fewer than in *A. gigas.*

*291. **Austenia resplendens,** *Nevill* (Helicarion), *J. A. S. B.* xlvi, 2, 1877, p. 23; *id. Yunnan Exped., Mol.* p. 883, pl. 80, figs. 6, 6 *a*; *id. J. A. S. B.* l, 1881, 2, p. 129, pl. 5, fig. 24; *Nevill*, Helicarion (Austenia), *Hand-l.* i, 1878, p. 16; *G. Tapp. Canefri, Ann. Mus. Civ. Gen.* xxvii, 1889, p. 315.

This is described as resembling *A. gigas*, but as being a little thinner and more membranaceous; it is at once distinguished from it by its flatter, more ear-like, and appressed shape.

Major diam. 22, min. 14, depth 8 mm.

Hab. Sawady and Bhamo, Upper Burma (*Dr. John Anderson*).

Judging by the figure, this shell appears to have about half a revolution more than *A. gigas.*

*292. **Austenia venusta**, *Theobald* (Vitrina?), *J. A. S. B.* 1870, 2, p. 400; *Pfr.* (Vitrina) *Mon. Hel.* vii, 1876, p. 512; *H. & T.* (Vitrina) *C. I.* 1876, pl. 152, fig. 5; *Godwin-Austen, Mol. Ind.* i, 1888, p. 237, pl. 59, fig. 5 (shell).

"Shell ovately ear-shaped, scarcely convex above, diaphanous, very thin, polished, subrugosely striated, bright yellowish brown; whorls $1\frac{1}{2}$, rapidly increasing; aperture very broad.

"Major diam. ·30, min. 17, height ·10 inch ($7\frac{1}{2} \times 4 \times 2\frac{1}{2}$ mm.).

"*Hab.* Near Chuegaley Tsekan, between Prome and Tongoop." (*Theob.* in Latin.)

The figure shows that this is very similar to *A. gigas*, though only about a third the size, and it may be the young, as *A. gigas* is said to be found in the Arakan Range. The shell from Ponsee in Yunnan, referred to this species by Nevill (J. A. S. B. 1877, 2, p. 24), is shown by Godwin-Austen to be different.

*293. **Austenia magnifica**, *Godwin-Austen & Nevill* (Helicarion), *J. A. S. B.* 1877, 2, p. 24; *Nevill*, Helicarion (Austenia), *Hand-l.* i, 1878, p. 16; *Godwin-Austen, P. Z. S.* 1880, p. 294, pl. 24, figs. 1, 2 (animal); *Nevill*, Helicarion (Austenia), *J. A. S. B.* 1881, 2, p. 129, pl. 5, fig. 23 (shell); *Godwin-Austen* (Girasia), *Mol. Ind.* i, 1888, p. 225, pl. 56, figs. 1, 2, 3 (animal), 4, 5 (shell). Helicarion (Austenia) feæ, *Canefri, Ann. Mus. Civ. Gen.* xxvii, 1889, p. 313, pl. 9, figs. 1–7.

Shell very similar to that of *A. gigas*, but much larger, of a brown, not a green colour, with the body-whorl much more flatly expanded, and the spire less convoluted and more depressed; also, looked at from underneath, very much less of the reflected body-whorl is visible.

Major diam. 46, axis $11\frac{1}{2}$, aperture $40\frac{1}{2}$ by $29\frac{1}{2}$ mm.

Hab. Teng-Yue-Chow or Momein in Yunnan, at 5500 feet (*Anderson*); near Bhamo (*Fea*).

The lobes of the mantle are united around the shell, which is completely covered when the animal is alive, and only a small portion exposed when the mantle is contracted in spirit. The line uniting the shell-lobes is distinctly seen. The mantle also covers much of the upper surface of the foot. [In this respect the animal is like that of *Girasia*, and is the reason why I placed it in that genus, the shell being different.] Mucous pore very long; spermatheca, as figured by Tappone Canefri, is very large; other generative organs as in *Girasia* generally.

In the radula the teeth of the middle row are as usual; the outer laterals bicuspid, long, curved, and pointed, the outer cusp much below the apex.

294. **Austenia nagaensis**, *Godwin-Austen* (Helicarion), *J. A. S. B.* xliv, 2, p. 5, pl. 2, figs. 3–3 *c* (shell and parts of animal); *id.* (Girasia) *P. Z. S.* 1880, p. 294; *id.* (Girasia) *Mol. Ind.* i, p. 224, pl. 61, figs. 3–3 *c* (shell and parts of animal).

[*Vide* fig. 64 C, p. 184.]

Shell very thin, membranaceous, ovate, apex forming a coil, not

projecting from the side; much broader than *Girasia hookeri*, covered with an olive epidermis showing lines of growth.

Major diam. about 22, min. about 14 mm.

Animal ochre-colour, prettily mottled and dotted with a darker shade of the same; the mantle covers nearly the whole shell; a narrow white line commencing near the posterior margin of the slit disclosing the shell extends round towards the respiratory orifice on the right-hand side, and in front another line curves round to the left anterior side. Length about 3 inches.

Hab. Angami Naga Hills, Assam.

295. **Austenia cacharica**, *Godwin-Austen* (Girasia), *Mol. Ind.* i, 1888, p. 240, pl. 59, figs. 4, 4 *a* (animal and shell), pl. 62, fig. 5 (teeth).
Helicarion solidum, *Godwin-Austen* (partim), *J. A. S. B.* 1875, 2, p. 6, pl. 2, figs. 5–5 *c* (animal and shell), *nec P. Z. S.* 1872, p. 518.

Shell oval, fairly solid, smooth, shining, colour pale olive; apex small, not projecting, very closely wound; whorls about $1\frac{1}{2}$; aperture ovate, occupying nearly the whole shell, only about a ninth being taken up by the reflected whorl, columellar margin evenly sinuate.

Major diam. 11, min. $6\frac{1}{2}$, height about 3 mm.

Hab. North Cachar Hills: Kohima, Dunsiri Valley.

Animal dark umber to pinkish grey, much speckled throughout, and with black lines on the side of the foot. Dorsal lobe ample, extending round to the left posterior side; right dorsal lobe rather small. The right shell-lobe is expanded over the apex, but is hardly connected behind; the left shell-lobe is narrow and laps over the peristome, but does not join the other lobe. The posterior margin and apex of the shell rests in a V-shaped depression of the ridge of the foot, and the hinder part of the foot thence to the mucous gland is very short.

The teeth of the radula are thus arranged: 40 . 15 . 1 . 15 . 40 (55 . 1 . 55). The inner laterals (admedians) have a well-formed cusp on the outer basal side; the outer laterals are very pointed and curved, with the outer cusp quite basal.

296. **Austenia solida**, *Godwin-Austen*, Helicarion (Hoplites), *P. Z. S.* 1872, p. 518, pl. 30, fig. 10 (shell); *H. & T.* (Vitrina) *C. I.* 1876, pl. 152, fig. 6; *Godwin-Austen* (Girasia), *Mol. Ind.* i, p. 241.

Shell close to *A. cacharica*, but considerably stronger and the apex thicker. The columellar margin of the peristome is much incurved.

Major diam. $14\frac{1}{2}$, min. 9, height $4\frac{1}{2}$ mm. A smaller specimen measures 9 mm. in major diameter.

Hab. Hengdan Peak, North Cachar Hills.

This may be the same as the last, but the shell shows slight differences. The animal is not known.

297. **Austenia peguensis**, *Theobald* (Vitrina), *J. A. S. B.* xxxiii, 1864, p. 244; *H. & T.* (Vitrina) *C. I.* 1876, pl. 65, figs. 2, 3; *Nevill*, Helicarion (Austenia), *Hand-l.* i, 1878, p. 16; *Godwin-Austen* (Girasia), *Mol. Ind.* i, 1888, p. 227, pl. 59, figs. 6–6 *b* (animal), 6 *c*, 6 *d* (shell); *Collinge* (Girasia), *Jour. Mal.* ix, 1902, p. 76.

Shell rather more solid than usual, semiovate, with the apex, which is very thick, projecting, polished, pale olivaceous or yellowish; spire flat, suture rather deeply impressed; about $1\frac{1}{2}$ whorls; aperture occupying almost the whole lower surface;

Fig. 69.—*Austenia peguensis.*

margin of peristome very convex, except near apex, where it is straight or slightly concave, inner portion of deeply concave columellar margin thickened in some shells.

Major diam. 16, min. 10, height $3\frac{1}{2}$ mm.

Hab. Pegu. Near the town of Pegu, and also on the west of the Irrawady in the Bassein district, and probably in the Arakan Hills farther north; Meetan, Tenasserim (*Fea*); also, according to Collinge, the Malay Peninsula, Belimbing, State of Ligeh.

The animal has a granulate mantle, the shell-lobes almost completely covering the shell when expanded. The mantle and its lobes are exactly as in *Austenia gigas*. The posterior part of the shell rests in a depression of the hinder part of the foot, though this is not so distinctly V-shaped nor so deep as in *Girasia hookeri*. Colour brown, mantle greyer and mottled, sides of the foot speckled with dark grey. Length of animal (when crawling) about 3 inches. Jaw and radula as in *Austenia gigas*. Teeth of radula 32 . 3 . 18 . 1 . 18 . 3 . 32 (53 . 1 . 53).

298. **Austenia shanensis**, *Godwin-Austen* (Girasia), *Mol. Ind.* ii, 1899, p. 107, pl. 91, figs. 3–3 *a* (shell and animal).

Shell ovate, convex above, polished, olivaceous horny; apex solid, flat, projecting less than in *A. peguensis*, suture impressed; whorls $1\frac{1}{2}$; aperture ovate, covering nearly the whole of the shell

beneath, margin of peristome convex almost throughout, becoming straight on margin near apex only.

Major diam. 11, min. 7, height 3 mm.

Hab. Shan Hills, Burma, east of Fort Stedman (*Woodthorpe*).

Animal dark grey, similar in form to *Austenia peguensis*. In the odontophore the inner laterals are bicuspid, the outer cusp far below the apical as in *A. gigas*, the outermost laterals small and unicuspid.

*299. **Austenia sikkimensis**, *Godwin-Austen*, Girasia (Ibycus), *Mol. Ind.* i, 1888, p. 239, pl. 59, figs. 2, 2 *a* (animal), 2 *b* (shell); *Cockerell* (Girasia), *A. M. N. H.* (6) vii, 1891, p. 106.

Girasia (Ibycus) sikkimensis, *var.* mainwaringi, *Godwin-Austen*, *Mol. Ind.* i, 1888, p. 240, pl. 59, figs. 3, 3 *a*, 3 *b* (animal); *Nevill*, *Hand-l.* i, 1878, p. 16, no. 37, H. (Austenia) n. sp.

Shell (from figure) ovate, the apex small, not projecting, much resembling the shell of *Austenia cacharica*.

Major diam. 9½ mm. (from figure).

Hab. Independent Sikhim, 9500 feet; Chungthung, on the Chakang Stream. Var. *mainwaringi* from Darjiling.

"The animal, from the spirit-specimen, appears to be of a pinkish grey when living. The mantle finely papillate and finely sprinkled with small black spots, a few similar distant markings on the side of the foot behind."

The var. *mainwaringi* must have been very dark-coloured when living, the mantle-lobes are finely papillate throughout. The foot is very short behind and cut off square.

In the odontophore the middle tooth of the radula is strongly tricuspid, the inner laterals as usual, the outer as in *gigas*, bicuspid, the inner point much longer than the other. The extreme outside laterals are very small.

This species has been regarded as allied to (or identical with) *Ibycus fissidens*, Heynemann, but the teeth of the radula appear to be very different. [The teeth of *I. fissidens* are very similar to those of the genus *Leptodontarion* of Sarasin.]

Genus **GIRASIA.**

Girasia, *Gray*, *Cat. Pulm. Brit. Mus.* p. 61 (1855); *Godwin-Austen*, *Mol. Ind.* i, 1888, p. 216.

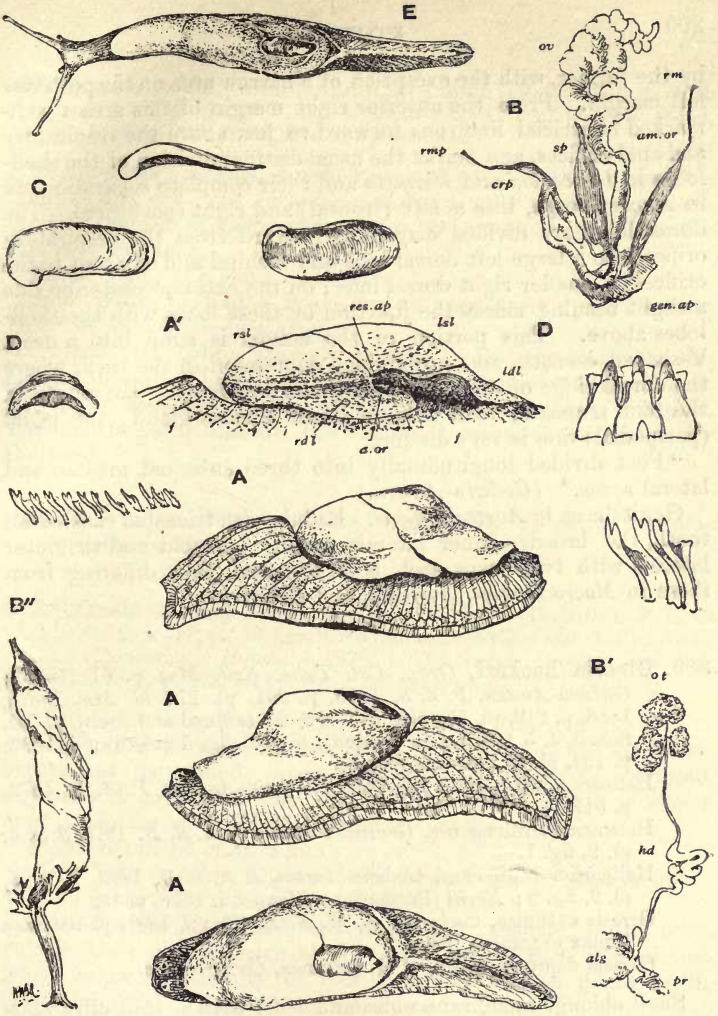
Hoplites, *Theobald*, *J. A. S. B.* xxxiii, p. 244 (1864).

Type, *G. hookeri*, Gray.

Range. Himalayas and Assam.

Shell ovate, usually membranaceous, with a more or less thickened apex, sometimes rudimentary, usually with an olivaceous epidermis; apex white.

"Animal slug-like, long, mantle largely developed; shell and dorsal lobes are united all round, and the shell is entirely covered



[Fig. 70.—*Girasia hookeri*, Gray.

A. View of right, left, and dorsal sides: drawn from a spirit-specimen. ⅔ nat. size.

A'. Position of shell- and dorsal lobes. Nat. size. The former grown together on the line running from the *res.ap.*; left dorsal lobe turned back to show the position of the respiratory and anal orifices.

B. Generative organs. ⅔ nat. size.

B'. Do., part of. × 3.

B''. Spermatophore. × 3.

C. The shell. ⅔ nat. size.

D. Jaw, enlarged, and radula. × 138.

E. *Girasia crocea*, Godwin-Austen.

al.g. Albumen-gland.
a.or. Anal orifice.
am.or. Amatorial organ.
crp. Cæcum of the retractor penis.
f. Foot.
k. Kalc-sac.
gen.ap. Generative aperture.
ldl. Left dorsal lobe.
lsl. Left shell-lobe.
ov. Oviduct.
ot. Ovo-testis.
rmp. Retractor muscle of penis.
rm. Retractor muscle.
rsl. Right shell-lobe.
rdl. Right dorsal lobe.
pr. Prostate.]

by the former, with the exception of a narrow area on the posterior left margin. From the anterior right margin of this area a well-marked cicatricial line runs forward to just above the respiratory and anal orifices, and marks the usual distinct division of the shell-lobes in *Helicarion* and *Durgella* and their complete separation, as in *Macrochlamys*, into a left (frontal) and right (posterior). The dorsal lobes are divided diagonally forward from the respiratory orifice into a large left dorsal lobe and (behind and adjacent to the orifices) a smaller right dorsal lobe; on the extreme posterior side a slight beading marks the junction of these lobes with the shell-lobes above. This portion of the animal is sunk into a deep, V-shaped, smooth, and unwrinkled depression in the back, where the dorsal ridge of the foot terminates suddenly. Extremity of the foot truncate, with a large linear mucous gland; the pedal (peripodial) line is very distinct.

"Foot divided longitudinally into three subequal median and lateral areas." (*Godwin-Austen.*)

Genitalia as in *Austenia gigas*. Radula with tricuspid rhachidian tooth, the broader inner laterals usually bicuspid and the outer laterals with two cusps each, both terminal, thus differing from those in *Macrochlamys*, *Austenia*, and *Helicarion*.

300. **Girasia hookeri**, *Gray*, *Cat. Pulm. Brit. Mus.* p. 61 (1855); *Godwin-Austen*, *P. Z. S.* 1880, p. 291, pl. 27; *id. Mol. Ind.* i, 1888, p. 219, pl. 55, figs. 1–1 *b*, 2–2 *b* (animal and shell), pl. 60, figs. 3, 4, 5 (animal in motion), pl. 62, fig. 1 (teeth); ii, 1899, p. 104, pl. 88 (spermatophore).

Helicarion (Hoplites) theobaldi, *Godwin-Austen*, *P. Z. S.* 1872, p. 517.

Helicarion shillongense, *Godwin-Austen*, *J. A. S. B.* 1875, 2, p. 4, pl. 2, fig. 1.

Helicarion brunneum, *Godwin-Austen*, *J. A. S. B.* 1875, 2, p. 5, pl. 2, fig. 2; *Nevill* (Parmarion), *Hand-l.* i. 1878, p. 13.

Girasia extranea, *Cockerell*, *A. M. N. H.* (6) vii, 1891, p. 104: *nec* Limax extraneus, *Fér.*

Girasia depressa, *subsp. of* G. extranea, *Cockerell*, *l. c.*

Shell oblong, membranaceous and soft, with a thin olivaceous epidermis, curled up so as to form an incipient spire at one end, drawn out into a broad ribbon-like stripe at the other. Length about 20 mm.

Animal varying from pale yellowish dull grey or pale brown to ochraceous or dark umber-brown, sometimes spotted on mantle. The mantle-lobes completely cover the shell, at times leaving a small area exposed; they also cover a considerable portion of the animal in front of the shell. Length of animal 3 to 4 inches.

Teeth in radula thus arranged: 95 . 2 . 18 . 1 . 18 . 2 . 95 (115 . 1 . 115). Of the broad teeth in the middle of the row the rhachidian has three cusps, the admedian two, one on the outer margin; all the outer laterals are bicuspid, the two cusps being terminal.

301. **Girasia radha**, *Godwin-Austen*, Helicarion (Hoplites), *J. A. S. B.* 1876, 2, p. 314, pl. 8, fig. 4 (animal crawling); *id. Mol. Ind.* i, 1888, p. 222, pl. 60, figs. 6, 6 *a* (animal).

Shell membranaceous, polished, a long strip with a projecting point at one end, not forming a distinct spire; colour greenish brown; margin of peristome convex, becoming concave on the side near the apex.

Major diam. 16½ mm.

Hab. Banks of Radha Pokri (tank), near Narrainpur, Darrang District, Assam (*Godwin-Austen*).

Animal rich ochre, sparsely dappled with grey-black on the mantle and tail. Length when extended 3 inches, mantle 1·3.

Near *G. hookeri*. Shell more rudimentary and colour different. The mantle quite conceals the shell and covers the animal as far the head.

[**Girasia? rubra**, *Godwin-Austen*, transferred to genus *Cryptogirasia*, p. 204.]

302. **Girasia crocea**, *Godwin-Austen*, Helicarion (Hoplites), *P. Z. S.* 1872, p. 517, pl. 30, figs. 9, 9 *a* (animal crawling and shell); *Nevill* (Parmarion), *Hand-l.* i, 1878, p. 13; *Godwin-Austen*, *Mol. Ind.* i, 1888, p. 223, pl. 60, fig. 2 (animal), pl. 62, fig. 6 (radula).

Shell very thin, flat, rudimentary, horny translucent, with a broad band of dark green from the apex to the edge of the membranaceous peristome; apex pointed and projecting, without any distinct coil; peristome convex throughout, except where it approaches the apex, when it becomes concave.

Major diam. 18, min. 8 mm.

Hab. Valleys below Cherra Punji, Khási Hills. Found creeping on high grass near Teria Ghat (*Godwin-Austen*).

Animal a fine bright saffron-yellow colour, mantle mottled with pale yellow; outside edge of foot very pale yellow and almost white below; extremity of foot truncate, with a gland as in *Austenia gigas*. Length of animal 2½ to 3 inches.

Odontophore quite peculiar. The middle tooth has three subequal cusps, all at the extremity, the next 9 on each side have a small outer cusp; the outer teeth are throughout evenly bicuspid, decreasing in size to the outermost laterals. They are thus arranged: 100 . 9 . 1 . 9 . 100 (109 . 1 . 109). This is quite different from any *Girasia*, and the only similar arrangement is found in *Durgella khasiaca*.

303. **Girasia pankabariensis**, *Godwin-Austen*, *Mol. Ind.* i, 1888, p. 225, pl. 59, figs. 1-1 *c* (animal).

"Animal with the right and left mantle-lobes united; the mantle appears to be slightly speckled. The shell is deeply sunk

in a depression, the ridge of the foot behind being on a level with the shell. Generative organs immature."

Length of specimen in spirit about an inch.

Hab. Pankabari, at foot of Himalayas, Sikhim.

Teeth in radula + 100 . 2 . 16 . 1 . 16 . 2 . 100 + (+118 . 1 . 118). All gradually decreasing in size from centre to margin. Jaw straight, with a very slight central projection.

*304. **Girasia dalhousiæ**, *Godwin-Austen, Mol. Ind.* i, 1888, p. 224, pl. 61, figs. 1, 1 *a* (animal), pl. 62, figs. 4, 4 *a* (jaw and teeth).

"The shell is of an olive-brown colour, convex above, oval on the periphery, membranaceous, broader than in the type or in *G. crocea*, with a very thin white shelly lining.

"Major diam. 13, minor 8 mm."

Hab. Dalhousie, Chamba Hills, west Himalayas (*Theobald*).

"The animal in spirit is of a pale ochre tint, with no markings of any kind. The mantle as in typical *Girasia*, the thin shell showing in an oval opening of the shell-lobes." Length in spirit 30 mm.

Radula thus arranged: 128 . 2 . 14 . 1 . 14 . 2 . 128 (144 . 1 . 144). Rhachidian tooth very narrow, long and tricuspid; inner laterals much curved and tricuspid, the inner cusp indistinct, points directed rather outwards; outer laterals bicuspid, the outer cusp larger and rounder in form than the inner. Jaws with a very slight central projection. The teeth differ from those of the more Eastern species.

*305. **Girasia burtii**, *Godwin-Austen*, Helicarion (Hoplites), *J. A. S. B.* 1876, p. 314, pl. 8, fig. 6 (shell); *id. P. Z. S.* 1880, p. 294; *id. Mol. Ind.* i, 1888, p. 222, pl. 61, fig. 2 (shell), pl. 62, figs. 3, 3 *a*, 3 *b* (teeth of radula, jaw, and genitalia; these are by error marked *G. radha*).

Shell dull white, very horny in texture, the apex scarcely developed, outline rounded above. Major diam. 0·30″ (8 mm.). The shell is figured as oval in shape, with the apex turned over in the middle, not towards one side as in many forms of *Girasia*.

Hab. Borelli Tea-garden, near Tezpur, Assam (*Burt*); also Paniputer Tea-garden, north of the Brahmaputra River in the same district.

Animal grey-brown in colour, measuring: mantle to head 0·4 inch, mantle 0·8, mantle to extremity of foot 0·5, or total length when moving 1·5 inches.

Jaw curved, no central projection. Rhachidian teeth narrow and long, tricuspid; inner laterals bicuspid, the cusps low down on outer side; outer laterals evenly bicuspid, both cusps terminal. In each row 186 . 2 . 6 . 1 . 6 . 2 . 186 (194 . 1 . 194), being 6 or more than in *G. hookeri*.

*306. **Girasia? cinerea**, *Godwin-Austen*, Helicarion (Hoplites), *J. A. S. B.* 1876, p. 314, pl. 8, fig. 2 (animal); *id. Mol. Ind.* i, 1888, p. 241, pl. 60, fig. 8 (animal).
[*Vide* fig. 64 B, p. 184.]

Shell not described. "Animal when fully extended long and narrow; colour dusky grey; mantle with a papillated surface slightly spotted, the spotting being coarser on the body and tail. Tentacles (eye-pedicels) short and blunt, with the oral (tentacles) very close below them.

"Length 0·75, mantle 0·4 ($18\frac{1}{2} \times 10\frac{1}{2}$ mm.)."

Hab. On the Darpang River, at foot of the Dafla Hills, under old logs in the forest (*Godwin-Austen*).

This species may be recognized by its bluish-grey colour and small size.

307. **Girasia affinis**, *Cockerell*, *A. M. N. H.* (6) vii, 1891, p. 106.

The shell in an alcoholic specimen is almost completely covered by the mantle, except a small space $3\frac{1}{2}$ mm. across. Both foot and mantle spotted with dark grey, and the whole length, when contracted in alcohol, is 42 mm. The posterior portion of the foot is very high and sharply ridged. The shell is evidently soft and membranaceous.

Hab. Pegu (*Theobald*).

308. **Girasia? dikrangensis**, *Godwin-Austen* (Testacella?), *J. A. S. B.* 1876, 2, p. 314, pl. 8, fig. 7; *Nevill* (Parmacella?), *Hand-l.* i, 1878, p. 13.

Shell ovate, slightly convex above, concave below, the apex inclined towards the left, but not involute nor forming a closed whorl; just below the apex there is an appearance as if one margin of the peristome were folded over the opposite one. The apex does not extend beyond the columellar margin of the peristome.

Major diam. 12, min. $6\frac{1}{2}$, height 2 mm.

Animal unknown.

Hab. Pachitah, Dikrang River, Dafla Hills, Assam (*Godwin-Austen*).

Only two dead shells have been found.

[The shell is very different from that of *Girasia*, being far more solid. It is placed here provisionally until living examples are obtained.]

[Genus CRYPTOGIRASIA.

Cryptogirasia, *Cockerell*, *A. M. N. H.* (6) vii, 1891, p. 99 (no description).

Type, *Girasia? rubra*, Godwin-Austen, only known from the Anghami Naga Hills.

Animal the most slug-like of any of the Indian forms, the shell being completely covered by the mantle and the shell itself reduced to an oval disk, the posterior end of the mantle resting in a

V-shaped depression. The extremity of the foot with a long soft overhanging lobe. Internal anatomy not known. It is represented by a single species, but no doubt others will be found on the eastern frontiers, Burmah, &c.]

309. **Cryptogirasia rubra**, *Godwin-Austen* (Parmarion), *J. A. S. B.* 1875, 2, p. 6, pl. 2, figs. 4–4 *c* (animal crawling and shell); *id. Mol. Ind.* i, 1888, p. 228, pl. 61, figs. 4 *a*–4 *d* (animal and shell). [*Vide* fig. 64 D, p. 184.]

Shell quite rudimentary, a small oval shelly disk about 3½ mm. long.

Hab. Kohima, Anghami Naga Hills (*Godwin-Austen*).

"Animal of a fine orange-pink, grey on underside of the foot; tentacles short; mantle entirely covering the shell, with only a slight trace of a longitudinal opening running back from the anterior left side; three parallel bands of greenish grey along the back of the neck, the eye-tentacles being of the same colour. The gland at extremity of foot with a long overhanging lobe."

Length of animal when moving 1·8 inches (45 mm.).

The generic relations of this animal are doubtful.

Genus **MARIÆLLA.**

Mariælla, *Gray, Cat. Pulm. B. M.* pt. 1, 1855, p. 62; *Webb, Proc. Mal. Soc.* iii, 1898, p. 151; *Godwin-Austen, Mol. Ind.* ii, 1899, p. 113.
Tennentia, *Humbert, Rev. et Mag. Zool.* 1862, p. 427, pl. 17.
Vega, *Westerlund, Vega-Exped.* iv, 1887, p. 188, pl. ii.
Dekhania, *Godwin-Austen, Mol. Ind.* i, 1888, p. 242, pls. 52 & 62.

Type, *M. dussumieri*, Gray.

Range. Western Ghats, from Mahableshwar southwards, and hill-country of Ceylon.

Shell internal, solid, ovate, convex above, flatly concave beneath, with a small apex, not coiled, lying on the right side as seen from about near the end.

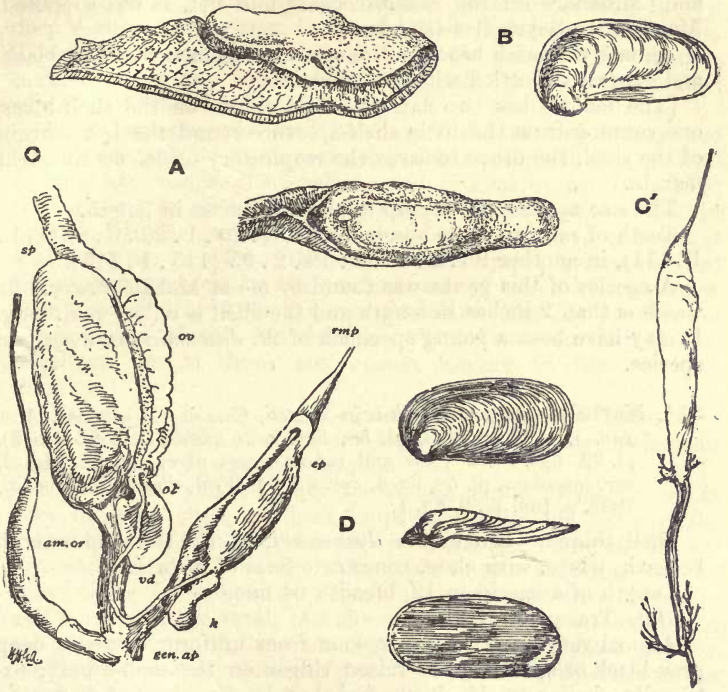
Animal very similar to that of *Girasia*, but the lobes of the mantle united into an oval shield, tricarinate above and completely covering the shell, only a small pinhole-like orifice [near the posterior end] being left open. From this small orifice a distinct line or cicatrix runs to the respiratory aperture on the right side, [marking the dividing line of the right and left shell-lobes]. The mantle extends forward over the neck, but not behind the shield, which is sunk behind in a depression of the back. The body behind the shield is sharply keeled above and terminates in a large mucous pore. Peripodial groove distinct as usual, but narrow, and sole tripartite longitudinally.

Genitalia and odontophore much resembling those of *Girasia*. The dart-sac is long and cylindrical. There is a large swelling of the free oviduct (ovitheca) just beyond the point where the vas deferens is given off. The spermatheca is rather irregularly ovate, and increases in size when containing numerous spermato-

phores, as in figure. The penis is provided with a small kalc-sac and gives off a short cæcum; the retractor muscle is attached to the bend.

The radula has a broad band of wider median teeth, tricuspid as a rule, and these pass into bicuspid outer laterals, with the two cusps subequal and terminal as in *Girasia*.

From *Girasia* the present genus is separated by its almost imperforate shield, the more solid shell of different form, and by several small distinctions in the genitalia.



[Fig. 71.—*Mariælla dussumieri.*

Dark olivaceous-green specimen.

A. Animal, view of right side and from above. ×1·8.
B. Shell. ×3·4.

Black specimen.

C. Genitalia. ×2.
C'. Spermatophore. ×3·4.

Mariælla beddomei.

D. Shell. ×1·8.]

310. **Mariælla dussumieri,** *Gray, Cat. Pulm. B. M.* 1855, p. 63 *Fischer* (Viquesnelia), *Journ. Conchyl.* 1856, p. 290, pl. 3, fig. 18; *Webb, Proc. Mal. Soc.* iii, 1878, p. 153, pl. 9, figs. 1–6 (animal, shell, and anatomy); *Cockerell, Nautilus,* xii, 1898, p. 9; *Godwin-Austin, Mol. Ind.* ii, 1899, p. 113, pl. 93, figs. 1–1 *c*, 2–2 *c* (animal, shell, and anatomy).

Tennentia thwaitesi, *Humbert, Rev. et Mag. Zool.* 1862, p. 42, pl. 17, fig. 1; *Semper, Reise Philip., Wiss. Res.* 1870, p. 7.
Vega nordenskioldi, *Westerlund, Vega-Exped.* iv, 1887, p. 188, pl. 2.

Shell in general thin, slightly convex, ovate, white, the apex forming a small point at the right side and near the posterior end, not involute.

Hab. The Western Ghats as far north as the Kadur district of Mysore and perhaps to Mahableshwar. Hill-tracts of Ceylon. The original locality was Mahe, a French town between Calicut and Cannanore on the Malabar coast, and not, as was supposed, Mahé in the Seychelles Islands.

Animal yellowish brown or olivaceous, sometimes almost black, and generally mottled with dark blotches.

[The mantle has two narrow raised ridges on the shell-lobes, one running from the little shell-aperture round the left margin of the shell, the other towards the respiratory orifice on the right margin.]

The size appears to vary up to about 8 inches in length.

Teeth of radula in one specimen 88 . 3 . 20 . 1 . 20 . 3 . 88 (111 . 1 . 111), in another 95 . 2 . 18 . 1 . 18 . 2 . 95 (115 . 1 . 115).

A species of this genus was found by me at Mahableshwar. It was less than 2 inches in length and the shell is only 7 mm. long. It may have been a young specimen of *M. dussumieri* or a smaller species.

311. **Mariælla beddomei,** *Godwin-Austen,* Girasia (Dekhania), *Mol. Ind.* i, 1888, p. 243, pl. 58, figs. 1–1 *b* (animal), 2–2 *b* (shell), pl. 62, figs. 7–7 *a* (jaw and radula), *var.* nigra, pl. 58, fig. 5, *var.* maculosa, pl. 58, fig. 4, *var.* fig. 6; *Webb, Proc. Mal. Soc.* iii, 1898, p. 154, pl. 9, fig. 7.

Shell thinner than in *M. dussumieri*, shelly, flat and smooth beneath, white, with close, concentric lines of growth.

Length of a specimen 12, breadth 6½ mm.

Hab. Travancore Hills.

Animal varying greatly in colour from uniform ochre to deep grey-black or spotted; [no raised ridges on the shell-lobes]; externally similar to *M. dussumieri*, but larger, about 4 inches in length when fully extended, and having more numerous teeth in the radula, the number in a row being 122 . 5 . 21 . 1 . 21 . 5 . 122 (148 . 1 . 148), and the shape differing somewhat. There are also differences in the genitalia, the spermatheca and the expansion in the free oviduct (ovitheca) having different forms.

Genus PSEUDAUSTENIA.

Pseudaustenia, *Cockerell, P. Z. S.* 1891, p. 225 (no description); *A. M. N. H.* (6) vii, 1891, p. 99.

Type, *P. atra*, Godwin-Austen.

Range. Hills of Southern India, Nilgiris, and Travancore.

Shell oblong or ovate, ear-shaped, flat above; apex slightly involute; none of the whorls enclosed beneath, the whole shell

lying open to the apex, and a slightly raised division alone separating the apical whorl.

Animal with shell-lobes turned over the shell and coalescing round it, not covering it when preserved in spirit. Right shell-lobe extending back towards apex, then terminating in a rounded end. Left shell-lobe continuous with right anteriorly, but separate behind. The left dorsal or neck-lobe covers a considerable part of the neck and extends along the left side to behind the shell. Back of foot behind the mantle flattened, not keeled, divided anteriorly into two well-developed lappets, forming between them a deep V-shaped depression, in which the shell and mantle are sunk. The posterior end of the foot terminates in a small linear mucous pore, overhung by a small lobe, the peripodial groove well marked; sole of foot tripartite longitudinally.

After removing the shell the uppermost of the visceral sac whorls are seen to be more developed in the animal than is usual in slug-like forms, the small hooked process of the liver-lobes [filling the apex of the shell] being much better developed than in *Girasia*. In the genitalia there is no dart-sac, the spermatheca is a globular sac on a tube; the male organ is simple, bent on itself at the retractor muscle, on the proximal side of which it is considerably expanded to form the spermatophore (fig. 72) just beyond the junction of the vas deferens, but there is no kalc-sac or flagellum, nor is there any cæcum leading to the retractor muscle.

[Radula 24 . 1 . 19 . 1 . 19 . 1 . 24 (44 . 1 . 44)]. The broader teeth in the middle elongate and tricuspid; the outer teeth small and bicuspid, only one cusp terminal.

This is distinguished from the African genus *Africarion* by its very different shell, its back lappets, and by the form of the male organ, which in *Africarion* [is much more simple, the *vas deferens* joining the shaft of the penis at the retractor muscle, there being no epiphallus. It differs materially from *Austenia* and *Girasia* in the shell, the absence of the amatorial organ, and the general form of the male organ, which has a *penis papilla*. Neither has it any relationship to *Ibycus* nor *Parmacochlea* as put forward by Mr. T. D. A. Cockerell (P. Z. S. 1891), the first genus being shown by its radula to belong to the *Durgellinæ*. The internal anatomy of *Parmacochlea* is in many points most unlike that of *Pseudaustenia atra*.]

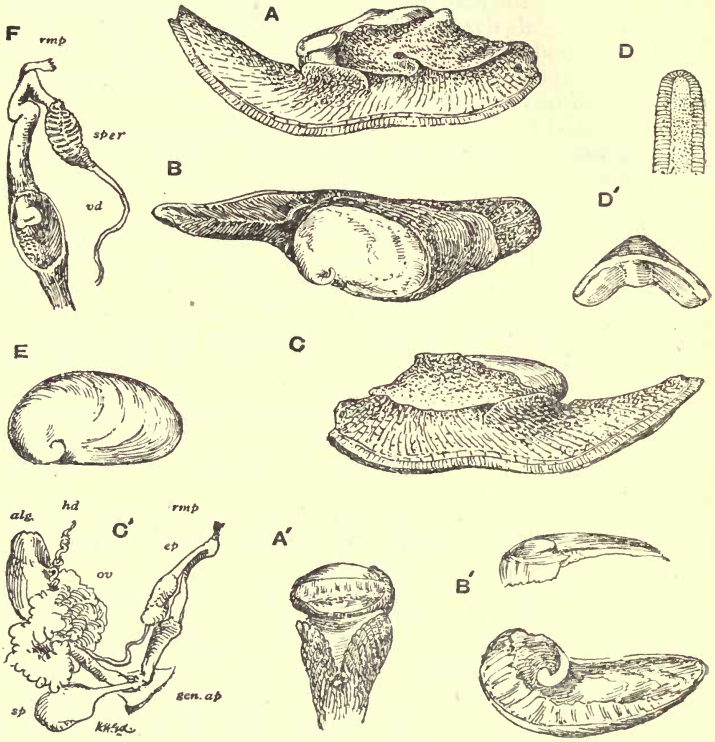
312. **Pseudaustenia atra**, *Godwin-Austen* (Africarion), *Mol. Ind.* i, 1888, p. 244, pl. 57, figs. 1–6 (animal, anatomy, and shells); *vars.* aterrima, cinerea, and castanea, *l. c.* p. 245.

Shell ovate, slightly convex above, concave below, smooth, covered with a straw-coloured or green membranaceous epidermis, which overlaps the peristome to a considerable extent; whorls $1\frac{1}{2}$, the apex, as in *Austenia*, is flat. All the lower surface of the shell

is open, and only a slight projecting ridge of shell separates the whole of the apex.

Length 12, breadth 7, about 2 mm. high.

Hab. Travancore and Tinnevelly Hills (*Beddome*).



[Fig. 72.—*Pseudaustenia atra.*

A. View of right side. × 1·8. Shell removed.
B. View of dorsal side. × 1·8.
C. View of left side. × 1·8.
D. Portion of sole of foot. × 1·8.
E. Shell of. × 1·8.
F. Male organ, showing spermatophore (*sper.*) in process of formation. × 3.

Pseudaustenia aterrima.

A′. Animal, seen from behind; shell not removed, showing the membranaceous peristome and the dorsal lappets. × 1·8.
B′. Shell. × 3. Right side and interior views.
C′. Genitalia. × 1·8.
D′. Jaw. × 9.]

Animal varying from chestnut or pale grey to black, more or less mottled and banded. Length, when living, about 50 mm.

(2 inches); the hinder part of the foot long and narrow, with a small mucous pore overhung by a small lobe. The foot is distinctly divided into three longitudinally. Radula 24 . 1 . 19 . 1 . 19 . 1 . 24 (44 . 1 . 44).

313. **Pseudaustenia auriformis**, *Blf.* (Vitrina) *J. A. S. B.* 1866, 2, p. 36; *Pfr.* (Vitrina) *Mon. Hel.* v, 1868, p. 15; *Nevill* (Helicarion), *Hand-l.* i, 1878, p. 16; *Godwin-Austen* (Africarion), *Mol. Ind.* i, 1888, p. 245, pl. 57, fig. 7 (shell).

Shell very depressed, oblong-ovate, very thin, smooth, convex without, with a greenish membranaceous epidermis, which projects beyond the peristome, nucleus paler; spire flat, about $1\frac{1}{2}$

Fig. 73.—*Pseudaustenia auriformis.*

whorls. Aperture occupying the whole lower surface of the shell and exposing the interior to the apex.

Length 13, breadth 8, height $2\frac{1}{2}$ mm.

Hab. Sispara Ghat, Nilgiri Hills.

Animal not known. The shell differs from that of *P. atra* by being more oblong and less elliptical, and by the smaller apex, the outline of which projects beyond the margin of the peristome.

Genus **CRYPTOSOMA.**

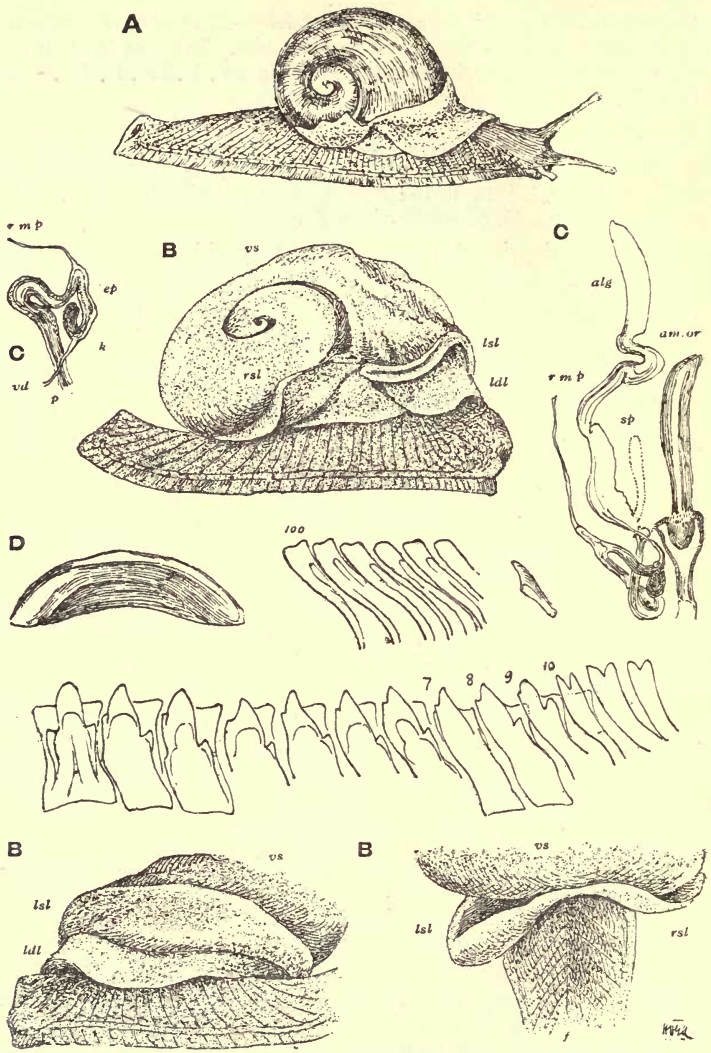
Cryptosoma, *Theobald, J. A. S. B.* xxvi, 1857, p. 252; *Godwin-Austen, Mol. Ind.* i, 1888, p. 14, pl. 4 (animal, shell, and details of anatomy); ii, 1898, p. 50 (anatomy).

Type, *C. præstans*, Gould.

Range. Burma, Siam, and Southern China to Hong-Kong.

Shell imperforate and with few whorls, like that of *Vitrina*, and only differing from *Helicarion* in being thicker, in the last whorl descending, and especially in having a stronger peristome, which, in the dry season, is furnished with an epiphragm.

Animal retractile within the shell. The lobes of the mantle are small as compared with those of *Cryptaustenia*, and cover a small part of the shell; right and left shell-lobes united at the back of the shell. A large gland at the posterior termination of the foot without any overhanging lobe. Peripodial groove well developed; sole of foot in three longitudinal divisions. Generative organs much as in *Austenia*; amatorial organ very large, spermatheca cylindrical. Odontophore with much more numerous lateral teeth than in Indian



[Fig. 74.—*Cryptosoma præstans*, Gould.

A. Animal, drawn from life. Nat. size.

B, B, B. Animal, from a spirit-specimen. Enlarged. Seen from the right and left sides, also part of dorsal side, showing junction of the right and left shell-lobes behind the visceral sac (*vs*).

C, C. Generative organs.

D. Jaw and teeth of the radula, from centre to the 12th; the 100th tooth and 5 adjacent, and one of the outermost.]

forms of *Helicarioninæ*; rhachidian tooth broad, with a small basal cusp on each side; inner laterals usually bicuspid, with the cusps on the outer side far from the apex; outer laterals with two subequal terminal cusps. This is scarcely worth generic rank, but the typical forms are easily recognized. The outer teeth in the radula differ considerably from those of *Cryptaustenia* and *Austenia*, and approach in character those of *Girasia*.

314. **Cryptosoma præstans,** *Gould* (Vitrina), *Bost. Jour. N. H.* iv, 1843, p. 456, pl. 24, fig. 2; *Pfr.* (Vitrina) *Mon. Hel.* ii, 1848, p. 497; *Theob. J. A. S. B.* xxvi, 1857, p. 252; *H. & T.* (Vitrina) *C. I.* 1876, pl. 65, figs. 5, 6; *Nevill,* Helicarion (Cryptosoma), *J. A. S. B.* xlvi, 1877, 2, p. 25; *id. Hand-l.* i, 1878, p. 14; *Godwin-Austen, Mol. Ind.* i, 1882, p. 14, pl. 4.
Austenia ? khyoungensis, *Godwin-Austen, P. Z. S.* 1888, p. 241.

Shell depressedly globose, rather solid, translucent, covered with an epidermis, having when fresh a resinous lustre, transversely striated, without spiral sculpture, pale greenish horny to brownish; spire very low, convex, apex not exserted, suture almost flat; whorls $3\frac{1}{2}$, slightly convex above, the last much larger, descending considerably towards the peristome, rounded at the periphery, rather swollen beneath; aperture very oblique, slightly contracted, almost semioval, breadth exceeding height; peristome not very thin, upper margin slightly arcuate, columellar curved throughout, receding, and meeting the penultimate whorl almost in a line, at a very open obtuse angle.

Major diam. 22, min. 17, height 12 mm.

Hab. Mergui, Moulmein, Martaban, Tenasserim Valley, Shan States (*Woodthorpe*); Sawady and second defile of the Irrawady, Upper Burma (*Anderson*); Upper Siam (*Daly*).

The rows in the radula are about 100 in number, each consisting of about 260 teeth, thus arranged: 120 . 2 . 7 . 1 . 7 . 2 . 120 (129 . 1 . 129). In the outermost laterals the cusps at the end disappear, and the teeth have blunt almost square terminations, [their form in this case perhaps due to being worn down].

The form from the Shan Hills, to which the name *khyoungensis* was applied, is a little more depressed than the Moulmein shell, measuring $20 \times 15\frac{1}{2} \times 10$ mm., but there does not appear to be any other difference. Other specimens from the Shan States are larger and measure $31 \times 24 \times 15$ mm.

The original type was described as spirally striate. No spiral striation can be found in shells from Moulmein or further north, but there are some subobsolete traces of spiral lines in Siam shells.

315. **Cryptosoma inusitatum,** *Godwin-Austen, Mol. Ind.* ii, 1898, p. 51, pl. 70, figs. 1–8.

Shell depressedly globose, thin, polished, smooth, with indistinct lines of growth, brown in colour; spire low, convex, apex not

projecting, suture almost flat; whorls 3, rapidly increasing, flatly convex, the last descending in front, rounded at the periphery; aperture lunately ovate, very oblique; peristome thin, margins converging.

Major diam. 25, min. 19½, height 14 mm. Other specimens measure 29½ mm. in major diameter.

Hab. Eastern Burma, about 300 miles N.E. of Moulmein (*Woodthorpe*).

The animal is much like that of *C. præstans*, the left shell-lobe covered with large oval tubercles intermixed with smaller, some pale-coloured, some black. The dart-sac is very large and attached by strong muscles almost throughout its length. The radula contains 132 rows of teeth, thus arranged: 140 . 3 . 17 . 1 . 17 . 3 . 140 (160 . 1 . 160), and the teeth are differently formed from those of *C. præstans*, the admedians more numerous, and the outer terminally bicuspid throughout.

316. **Cryptosoma? birmanicum**, *Phil. Zeitsch. f. Mal.* 1847, p. 65; *Pfr. Mon. Hel.* ii, 1848, p. 498; *H. & T. C. I.* 1876, p. 61, pl. 152, fig. 7; *Nevill* (Helicarion), *Hand-l.* i, 1878, p. 14.

Shell depressedly globose, thin, pellucid, very smooth and polished, pale horny; spire low, suture slightly impressed; whorls 3½, convex, the last rounded at the periphery, descending in front; aperture oblique, roundly lunate, broader than high; peristome thin.

Major diam. 11, min. 8, height 5½ mm.

Hab. Near Mergui (*Philippi*).

There are two specimens of shells with this name in the British Museum. Though they differ a little from Philippi's and Pfeiffer's descriptions they agree, on the whole, fairly.

317. **Cryptosoma austeni**, *Collinge, Jour. Mal.* vii, 1898, p. 2, pl. 1, figs. 1–5.

"Shell: apex depressed, thin, striæ definite, brownish or horn colour." Whorls 3½.

Animal light yellowish brown, darker on the head and posterior dorsum, which latter is shortly keeled. Right shell-lobe well-developed, left lobe very large.... Caudal mucous pore large, with no overhanging groove.... Foot-sole divided. Length of animal (in alcohol) 22·5 mm.

Hab.? Sent from Calcutta, but probably derived from some other place.

In a brief account of the anatomy it is pointed out that the generative organs differ in several points from those of *C. præstans*. [The shell is very unlike that of *Cryptosoma*; more like that of *Cryptaustenia bensoni*.]

[Subfamily DURGELLINÆ.

Durgellinæ, *Godwin-Austen, Mol. Ind.* i, 1888, p. 253 (typical genus *Durgella*); ii. 1898, p. 60.

Shell globose or much depressed, thin, often membranaceous. Animal with ample shell-lobes on both sides, nearly concealing the shell in life. The amatorial organ is present in some genera, absent in others. The radula is very broad, with a great number of similar, closely-packed, curved teeth on narrow plates, in some species as many as 400–500, either plain or with a pectinate side. Jaw generally thin and weak, stouter in some.]

Genus **DURGELLA.**

Durgella, *Blf. A. M. N. H.* (3) xi, 1863, p. 81; *Godwin-Austen, Jour. Linn. Soc., Zool.* xv, 1881, p. 291 (anatomy); *id. Mol. Ind.* i, 1883, p. 142; ii. 1898, p. 60; ii, 1907, p. 205.

Type, *D. levicula*, Bs.

Range. Probably the greater part of the Indo-Malay Region.

Shell thin, *Vitrina*-like, of four whorls, with a large oblique mouth.

Lobes of the mantle partially covering the shell when expanded, the right shell-lobe being broad and triangular, the left also triangular and reflected over the edge of the shell from near the respiratory orifice. Dorsal lobes moderate. A broad peripodial fringe; the mucous pore is well developed, with a large overhanging lobe; sole divided into 3 parts longitudinally. In the generative organs a dart-sac is large and usually present, sometimes absent; the spermatheca is of moderate size, wide at the base, then constricted, and broader again at the end; there is no distinct kalc-sac, though an expansion may be noticed at the junction of the *vas deferens*.

The jaw is thin, membranaceous, almost straight on the cutting-edge. The odontophore is broader than long, with a minute rhachidian tooth, generally unicuspid; the lateral teeth are excessively numerous, there being no broad plates near the middle, but a gradual diminution takes place in size from the innermost to the outermost tooth, all having a serrated curved edge with numerous cusps.

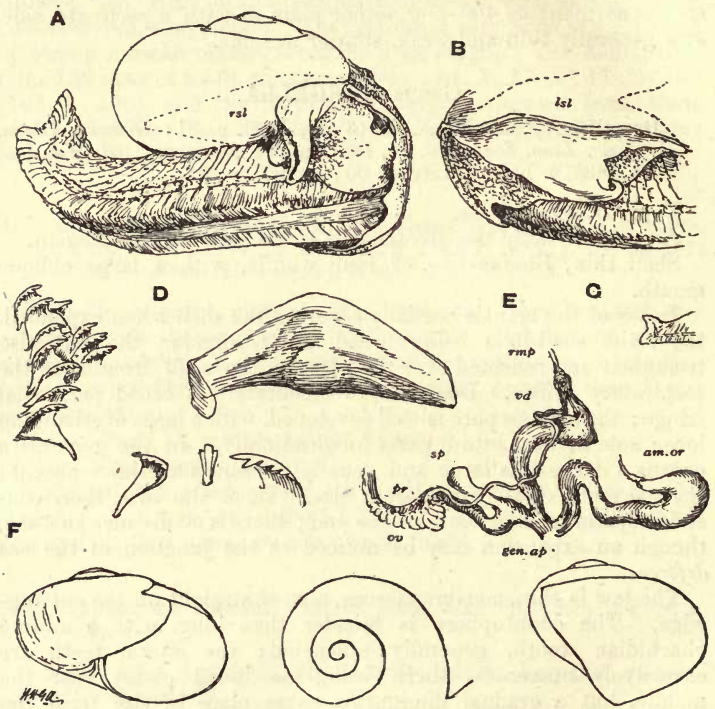
a. *Typical forms from Eastern Himalaya, Assam, and Burma.*

318. **Durgella levicula**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 391; *Blf. A. M. N. H.* (3) xi, 1863, p. 81; *id.* (Nanina) *J. A. S. B.* 1865, 2, p. 87; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 48; *H. & T.* (Helix) *C. I.* 1876, pl. 90, figs. 1, 4; *Godwin-Austen, Jour. Linn. Soc., Zool.* xv, 1881, p. 291 (anatomy); *Nevill* (Nanina), *Hand-l.* i, 1878, p. 26; *Godwin-Austen, Mol. Ind.* i, 1883, p. 142; *id. t. c.* ii, 1898, p. 61, pl. 76, figs. 1–6 (anatomy).

Shell subperforate or very narrowly perforate, globosely de-

pressed, thin, almost smooth, more or less polished, translucent, whitish horny, in some cases faintly striated with subobsolete spiral lines; spire convex, apex obtuse, suture impressed; whorls $3\frac{1}{2}$, rapidly increasing, the last rounded at periphery, moderately tumid beneath; aperture oblique, large, roundly lunate; peristome thin, slightly arcuate above, columellar margin subvertical, slightly reflected.

Major diam. $8\frac{1}{2}$, min. 7, height 5 mm.



[Fig. 75.—*Durgella levicula.*

A. Animal, view of right side. From a spirit-specimen.
B. Ditto, left side. Ditto, much enlarged.
C. Extremity of foot and lobe above mucous gland, as in life.
D. Jaw, × 3, and teeth of radula, the centre and admedian.
E. The generative organs. × 6.
F. Shell, with sutural spiral. × 3.]

Hab. Tenasserim; Phie Than, Methan at base of Mule-it Range, &c. This or closely allied forms are found in Pegu, also Balasore Hills, Orissa (*W. T. B.*); Golconda in North-eastern Madras (*Beddome*).

Animal pale ochre, with a dusky line on the upper part of the

extremity of the foot, also on the neck, tentacles moderately long.

Mantle-lobes moderately developed. Spermatheca thick, short, and wide at the base, with a swollen wide terminal portion. Dart-sac large, cylindrical, but twisted in form. The *vas deferens* joins the male organ close to the retractor muscle; without kalc-sac.

The teeth in the radula exceed 170 . 1 . 170: the rhachidian tooth is very minute; the laterals very numerous and closely set together, their upper edge serrated with 5 or 6 points each, and they diminish gradually in size outwards. There are upwards of a hundred rows of teeth in the odontophore. The jaw is very thin and membranaceous, nearly straight in front.

[319. **Durgella rogersi**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 205, pl. 115, figs. 4, 4 *a*, pl. 116, figs. 7, 7 *a*.

Shell globose, very thin, membranaceous: it was impossible to remove the animal preserved in spirit without tearing it. Whorls $3\frac{1}{2}$; colour pale straw, apex flatly rounded.

Hab. Paphunta Valley, South Andamans (*G. Rogers*).

Animal about 20 mm., contracted in spirit. Foot long behind, pointed, keeled, narrow; sole divided; peripodial grooves with parallel streaking running from them to the margin of the foot. A fairly large rounded right shell-lobe rising on the side of the right dorsal lobe; the left shell-lobe smaller than the right, rounded on the margin; both shell-lobes somewhat thickened, pale-coloured, unmarked, and smooth.

The genitalia were not, unfortunately, got out in a state for description. The penis is simple, like that of *D. levicula*; no amatorial organ seen.

Jaw very thin, almost straight in front, only a slight convexity in the middle.

Radula consists of an enormous number of teeth; there are at least 500 in the row, and 70 rows can be counted. It was got out in a nearly perfect state, but the filmy edges got folded under it; and it is most difficult when this occurs to spread them out again, rendering counting impossible. The teeth are more numerous in this radula and more minute than in any I have seen hitherto; they are in form of similar type to those of *Durgella levicula* and *mairangensis*, of Tenasserim and the Khasi Hills respectively, but still closer to the outermost teeth of *Durgella*? *sumbaensis*, G.-A. (*vide* Mol. Ind. vol. ii, pl. 79, fig. 8 *b*), which may possibly belong to *Lamprocystis*, and points to this last genus having a position rather with the subfamily *Durgellinæ* than any other.]

320. **Durgella concinna**, sp. n.

Nanina levicula, *Blf. J. A. S. B.* 1865, 2, p. 87, pt.; *Nevill, Hand-l.* i, 1878, p. 26, pt.: *nec Bs.*

Shell subperforate, depressedly globose, fairly solid, smooth, with

a resinous lustre, translucent, pale, almost whitish horny; spire low, convex, apex obtuse, suture shallow; whorls $3\frac{1}{2}$, rapidly increasing, slightly convex above, the last ascending near the mouth, rounded at periphery, rather tumid beneath; aperture oblique, roundly lunate; peristome thin, margins converging, columellar curved, vertical above, slightly reflected.

Major diam. 7, min. 6, height 4 mm.

Hab. Thayet Myo, Prome, and Akauktoung in Upper Pegu.

This is distinguished from *D. levicula* by being much more solid, by lower spire, and much smaller mouth, the diameter of which measures $3\frac{1}{2}$ mm. in a specimen 7 mm. in major diameter, whilst in a *D. levicula* of similar size it is over 4.

321. **Durgella erratica**, *Godwin-Austen* (Austenia), *P. Z. S.* 1888, p. 241.
Nanina levicula, *Blf. J. A. S. B.* 1865, 2, p. 87, pt.; *Nevill, Hand-l.* i, 1878, p. 26, pt.: *nec Bs.*

Shell openly perforate, globosely depressed, thin, translucent, smooth, slightly polished, pale amber or brownish; spire nearly flat, slightly convex, suture shallow; whorls $3\frac{1}{2}$–4, rapidly increasing, flatly convex above, the last much larger, scarcely descending in front, rounded at the periphery, convex beneath; aperture oblique, diagonal, ovately lunate; peristome thin, upper margin slightly depressed, columellar oblique, reflected.

Major diam. 8, min. 7, height 4 mm.

Hab. Pingoung, Shan Hills, Burma (*Spratt*); Bassein District, Pegu (*W. T. B.*). Distinguished from *D. levicula* by more open perforation, a rather thicker shell, and a smaller mouth.

*322. **Durgella assamica**, *Godwin-Austen, Jour. Linn. Soc., Zool.* xv, 1881, p. 294, pl. 20, figs. 5, 6, 8, pl. 21, figs. 2, 4, 4 *a*, 6; *id. Mol. Ind.* ii, 1898, p. 63, pl. 77, figs. 1–6 (shell and anatomy).
[*Vide* fig. 76, B–B 4, p. 220.]

Shell imperforate, subglobosely depressed, thin, membranaceous, smooth, olive-brown; spire low, suture impressed; whorls 4, rapidly increasing; aperture ovately lunate, oblique; peristome thin.

Major diam. 9·5, min. 8·2, height (from figure) 5 mm.

Hab. Paniputer tea-garden near Tezpur, Assam (*Lumsden*).

No dart-sac found in the two specimens examined. Spermatheca longer than in *D. levicula*. A large overhanging lobe to the mucous pore. Peripodial lines strongly marked and triple. Odontophore as in *D. levicula*.

*323. **Durgella mairangensis**, *Godwin-Austen, Mol. Ind.* ii, 1898, p. 64, pl. 77, figs. 7–11 (shell, details of anatomy, and radula).
Helicarion salius, *Godwin-Austen, J. A. S. B.* 1876, 2, p. 313: *nec Bs.*

Shell globosely depressed, thin, smooth, shining, pale straw-colour; spire very low, almost flat, suture shallow; whorls 3, the last rounded, tumid beneath; aperture oblique, descending, ovately

lunate, columellar margin oblique until close to last whorl, where it becomes vertical, slightly thickened, and reflected.

Major diam. 7·5, min. 5, height (from figure) 3·75 mm.

Hab. Mairang, North Khasi Hills (*Godwin-Austen*).

Animal pale yellowish, rather more orange on foot, a dusky line on upper surface of extremity of foot. Length about 0·6 inch. Dart-sac present; spermatheca rather short. Rows of the odontophore with 320 . 1 . 320 teeth, which are larger than in *D. levicula*.

This is very near *D. salius*, and has the same habit of jumping when touched.

324. **Durgella salius**, *Bs.* (Vitrina) *A. M. N. H.* (3) iii, 1859, p. 189; *Pfr.* (Vitrina) *Mon. Hel.* iv, 1859, p. 799; *H. & T.* (Vitrina) *C. I.* 1876, pl. 65, figs. 8, 9; *Nevill* (Helicarion), *Hand-l.* i, 1878, p. 14; *Godwin-Austen* (Austenia), *Mol. Ind.* i, 1883, p. 152, pl. 37, fig. 1; *id. t. c.* ii, 1898, p. 65.

Shell imperforate, subglobosely depressed, not very thin, smooth, more or less polished, sometimes indistinctly closely striated, translucent, pale yellowish ochraceous; spire scarcely convex, apex not prominent, suture very slightly impressed; whorls 3½, rather flattened above, the last sometimes descending a little in front, rounded at periphery and beneath; aperture oblique, lunately subovate; peristome not very thin, margins converging, upper very slightly arcuate, columellar sinuate, rounded, subvertical above.

Major diam. 9½, min. 7, height 4½ mm.

Hab. Khasi Hills, Teria Ghat; Lower Himalayas of Sikhim, common at Pankabari.

Animal not examined. In one shell there is part of an epiphragm remaining. Col. Godwin-Austen has suggested (Mol. Ind. ii, p. 65) that this species belongs to *Durgella*. The name is derived from the jumping habits of the animal.

*325. **Durgella? seposita**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 267; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 51.

"Shell imperforate, conoidly subglobose, thin, obsoletely obliquely striated, white, covered with a horny epidermis; spire low, conoidal, apex obtuse, suture slightly impressed; whorls 3, scarcely convex above, the last large, ventricose, forming almost the whole shell, area around the umbilicus slightly hollowed; aperture large, oblique, roundly lunate; peristome thin, straight, columellar margin descending with a curve, scarcely expanded.

"Major diam. 7, min. 5½, axis 5 mm.; length of aperture 4½, breadth 4." (*Benson*, in Latin.)

Hab. Near Darjiling.

Although Sikhim has been very thoroughly searched since this species was named, no other specimens have been found, and

there must remain some doubt as to whether there may not have been an error in the locality, or whether the solitary specimen procured was not the young of some better-known shell. Two specimens from Theobald's Collection, now in the British Museum, do not agree satisfactorily with the original description.

b. *Aberrant form.*

*326. **Durgella khasiaca**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 145, pl. 39, figs. 7, 7 *a*, 7 *b*, 8, 8 *a*, 8 *b* (shell, jaw, and radula).

"Shell depressedly ovate, thin, horny, shiny, smooth, with close, fine, transverse lines of growth; colour pale ochraceous olive; spire very depressed, flatly convex. suture shallow; whorls 3, rapidly increasing; aperture oblique, flatly ovate; columellar margin but weakly developed." (*Godwin-Austen.*)

Major diam. 6·7, min. 5, height (from figure) 3 mm.

Hab. West Khasi Hills.

The radula is very remarkable; it contains 250 . 1 . 250 teeth in 120 rows: the rhachidian is elongate, with three terminal equal-sized points; the lateral teeth are all alike, much curved and terminally bicuspid, the outer point slightly in advance of the inner. All decrease gradually in size outwards. Jaw thin and horny, nearly straight in front.

There is some slight resemblance to the radula of this species in *Girasia crocea*, but both shell and animal are very different.

Genus **IBYCUS.**

Ibycus, *Heynemann, Mal. Blätt.* x, 1862, p. 142.

Leptodontarion, *subg. of* Helicarion, described by *Paul & Fritz Sarasin, Land-Mollusken von Celebes*, p. 124 (1899).

Type, *I. fissidens*, Heynemann.

Range. Sikhim.

The original type of this genus was a spirit-specimen in very bad condition, all the posterior half of the body, half the mantle, and part of the shell having been lost. The radula shows remarkable characters. There is no median row of broader plates as in so many Limacidæ; the rhachidian tooth is much broader at the base than at the point, the shovel-like point rising up like a spoon. The side teeth have two cusps, each projecting forward and connected with a plate behind, and pass gradually into rather smaller but similar teeth, each side of a row running backward from the middle tooth, "so as to resemble a flight of cranes." The jaw has a projecting median process, as generally seen in *Macrochlamys*, thus differing from other species of the *Durgellinæ*.

With this remarkable form Col. Godwin-Austen's *Durgella minuta* may perhaps be connected, as it has a somewhat similar radula.

[The shell of the type species is very different from that of *minuta*,

being conoid, of $3\frac{1}{2}$ to 4 whorls, and the Sarasins do not describe the internal anatomy, which may prove very different from *Ibycus*. I give figures of the radula of both *Leptodontarion albacuminatus* and *L. coriaceus* (fig. 76, D, E, p. 220). *Leptodontarion* should be included in the subfamily *Durgellinæ*.]

327. **Ibycus fissidens**, *Heynemann, Mal. Blätt.* x, 1862, p. 142, pl. 1, fig. 3 (radula).
[*Vide* fig. 76, C, p. 220.]

Shell imperfect, convex, horny-leathery, brittle, translucent, amber-coloured, highly polished, with neat lines of growth. It is shovel-shaped, with the apical portion wanting, and may be part of a shell like that of *Girasia*.

The breathing-orifice appears to lie far forward. A mantle covers the anterior half of the body and, as in *Limax*, is united with the sole. Surface of the mantle distinctly tubercular. Jaw with a prominent centre.

Radula as described under the genus. No size mentioned. The shell, if figured of natural size, may have been half an inch long, and the whole animal possibly 2 inches, but this is uncertain.

Hab. Sikhim, at a height of 5600 feet (*Schlagintweit*). It should be remembered that some of the Schlagintweit collections, from Sikhim especially, were wrongly labelled.

328. **Ibycus minutus**, *Godwin-Austen* (Helicarion), *J. A. S. B.* 1876, 2, p. 313, pl. 8, fig. 1; *id.* (Durgella) *Mol. Ind.* i, 1883, p. 144, pl. 39, figs. 1–6 (shell, animal, radula, &c.).
[*Vide* fig. 76, A–A 5, p. 220.]

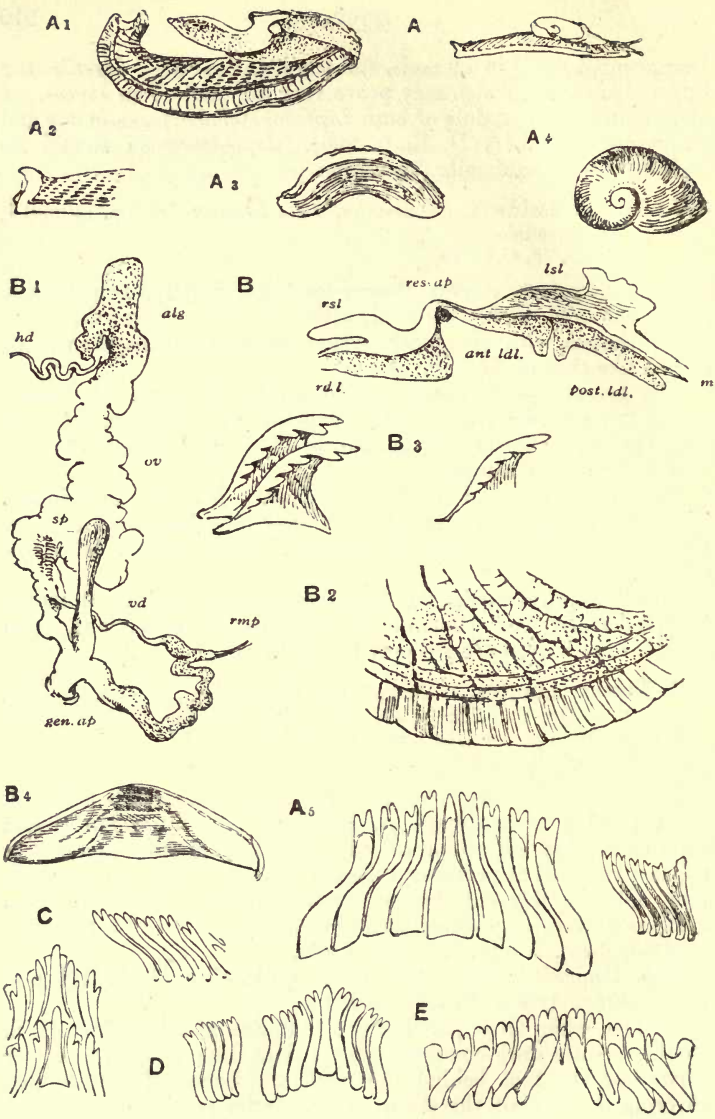
Shell imperforate, depressed, ovate, translucent, smooth, polished, lower portion membranaceous, brownish with an olive tinge; spire nearly flat, suture impressed; whorls $2\frac{1}{2}$, rapidly increasing, the last rounded at periphery, slightly flattened beneath; aperture very oblique, diagonal, lunate, roundly ovate; peristome thin, margins converging, columellar above slightly inclined to the right.

Major diam. 7, min. 5, height 3 mm.

Hab. Under Toruputu Peak, Dafla Hills, also Jaintia Hills and Noa Dehing, Assam (*Godwin-Austen*).

Animal, when alive, pale horny; tentacles and line from them to the mantle dark-coloured, also a dark line down the upper surface of the foot behind the mantle. Lobes of mantle just covering the edge of the shell. The anterior portion of the body is much shorter than the posterior portion. Total length about 0·7 inch. A well-marked hooked process above the mucous gland. The middle portion of the sole of the foot is black throughout.

Radula with a straight unicuspid rhachidian tooth, increasing in width near the base, and numerous curved lateral bicuspid teeth, similar in form to each other and gradually decreasing in size as they are inclined backwards on each side of the central tooth. There is thus a very considerable likeness to the arrangement in



[Fig. 76.—*Ibycus minutus.*

A. Animal, from life, natural size, right side view.
A 1. Ditto, from spirit-specimen, right side view. × 4.
A 2. Ditto, extremity of foot in life. A 4. Shell. × 2·4.
A 3. Jaw. × 20. A 5. Teeth of the radula. × about 625.

Durgella assamica.

B. Mantle-zone, removed from animal to show the shell- and dorsal lobes: enlarged. B 1. The genitalia: much enlarged.
B 2. Portion of side of foot, to show the three peripodial grooves.
B 3. Three teeth of the radula. B 4. Jaw. × 15.

C. *Ibycus fissidens*, teeth of radula (after Heynemann).
D. *Leptodontarion albacuminatus* (after P. & F. Sarasin): highly magnified.
E. —— *coriaceus* (ditto): ditto.]

Ibycus. [There was sufficient to show in the generative organs the presence of the amatorial organ and simple form of male organ.]

Animal not differing much from *Durgella*. Col. Godwin-Austen has called attention to the similarity of the radula in the Assam and Celebes shells of the genera *Ibycus* and *Leptodontarion*.

Teeth in the radula 190 . 1 . 190 in each row. Jaw slightly arched, without a median projection.

Genus **SATIELLA** *.

[Fig. 77, p. 222.]

Type, *S. dekhanensis*, Godwin-Austen.

Range. Southern India.

Shell very thin and membranaceous, *Vitrina*-like, depressedly globose or depressed, with few whorls and a large mouth.

Mantle with well-developed shell-lobes extending over the shell. Behind the shell the foot is generally carinate and ends posteriorly in a long lobe, on the under side of which is the mucous pore. The sole has a median and two lateral tracts, clearly divided. There is no dart-sac or amatorial organ; the spermatheca is club-shaped, a pear-shaped or cylindrical body with a narrow neck opening into the oviduct. The vas deferens expands gradually into a wider portion (epiphallus?) leading to the short cæcum, to which the retractor muscle is attached.

Teeth very numerous, in *S. levidensis* (fig. 77, F) 350 to 400 on each side of the rhachidians; the median and admedian teeth appear to be bicuspid, whilst some of the outer teeth have a multicuspid outer edge like that of a saw.

Both the shell and radula differ considerably from those of *Durgella*.

329. **Satiella dekhanensis**, *Godwin-Austen* (Durgella), *Mol. Ind.* ii, 1898, p. 68, pl. 78, figs. 1–2 *d* (shell and animal); var. *bicolor*, figs. 3–5 (shell, animal, and generative organs).
[Fig. 77, A, B.]

Shell very thin, quite membranaceous and soft, depressed, translucent, smooth, polished, rich sienna-brown in colour; spire low, apex flat, suture linear; whorls $3\frac{1}{2}$, the last large, sometimes angulate at periphery (perhaps through pressure); aperture lunately ovate; peristome very thin.

Major diam. 18·5, min. 15, height about 8 mm.

Hab. Travancore, in Southern India.

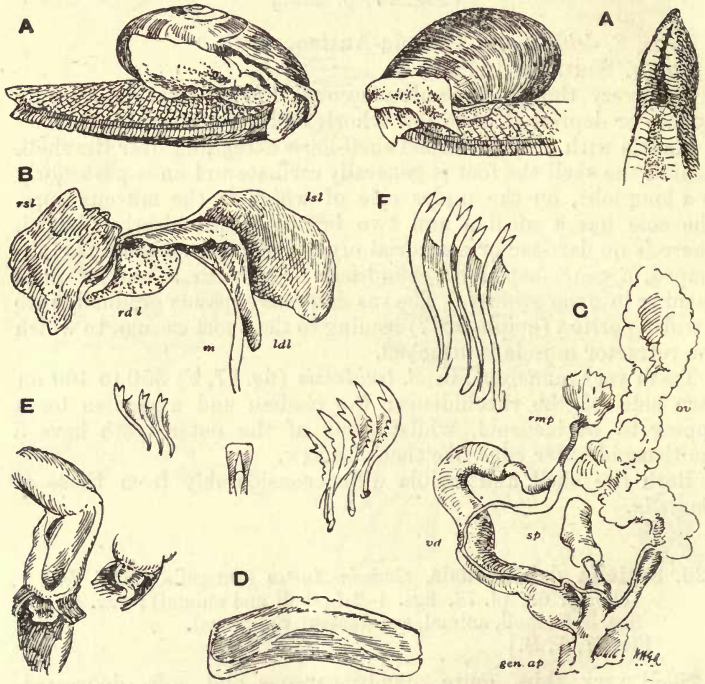
The shell is so soft that it is difficult to say whether the periphery is subangulate or not.

Animal (fig. 77, A) with a narrow foot, sharply keeled behind, and

* From "Sati" or "Durga," also known as "Parvati."

a pointed lobe overlying the narrow linear mucous gland. Shell-lobes (B) ample and probably in life cover the whole shell; they are smooth and paler than the remainder of the animal; they are not continuous round the back of the shell as in *Austenia*. Animal grey or pale ruddy ochre. Jaw (D) soft and horny, straight in front. Teeth very numerous; central tooth minute, pointed; lateral teeth serrated; minute as in *S. levidensis*.

In the genitalia (C) no dart-sac; a penis papilla (E). The spermatheca is a moderately long blunt sac, attached by a short stem. The retractor muscle of the penis is very strong, given off where the vas deferens joins; no trace of a kalc-sac or flagellum.



[Fig. 77.—*Satiella dekhanensis.*

A. Animal, view of the right and left sides, life-size, and extremity of foot from beneath, × 6. From spirit-specimen.
B. Mantle-zone detached from the animal, showing shell- and dorsal lobes.

Satiella dekhanensis, var. *bicolor*.

C. Generative organs. × 3.
D. Jaw. × 18.

Satiella levidensis.

E. Male organ opened out on side. × 3.
F. Central tooth and admedians, × 276, and four admedian teeth still more enlarged.]

330. **Satiella christianæ**, *Theobald* (Vitrinia), *J. A. S. B.* xxxiii, 1864, p. 245; *H. & T.* (Vitrina) *C. I.* 1876, pl. 66, figs. 7, 10: *Nevill* (Helicarion), *Hand-l.* i, 1878, p. 14: *Godwin-Austen, A. M. N. H.* (5) viii, 1881, p. 377; *id.* (Durgella) *Mol. Ind.* ii, 1898, p. 65, pl. 79, figs. 1–5 (shell, animal, and anatomical details).

Shell imperforate, globosely depressed, thin, translucent, smooth, polished, pale yellowish horny; spire almost flat, suture impressed; whorls $3\frac{1}{2}$, convex, rapidly increasing, the last rounded at periphery, swollen below; aperture oblique, roundly lunate; peristome thin, slightly arcuate above, columellar margin subvertical.

Major diam. 13, min. 11, height 8 mm. A smaller specimen is $10 \times 5 \times 6$ mm.

Hab. Andaman Islands, Port Blair.

Animal in spirit-specimen about $1\frac{1}{2}$ inches long. Whole body dark, with the shell-lobes conspicuously pale-coloured. Shell-lobes of mantle large. No dart-sac; the spermatheca long and small, expanding at the end into a large pear-shaped sac.

In each row of the radula there is a very minute rhachidian tooth, terminally bicuspid, followed by curved bicuspid laterals, towards the margin these laterals show the pectiniform edges characteristic of the genus. Jaw straight, with a slightly convex edge.

It will be seen that the teeth of this radula differ considerably from those of *S. levicula* and its allies.

331. **Satiella levidensis**, *Godwin-Austen* (Durgella), *Mol. Ind.* ii, 1898, p. 78, pl. 68, figs. 6-9 (shell, animal, and radula). [Fig. 77, E, F.]

This is distinguished from *S. dekhanensis* by its much higher spire, globose form, and smaller size; whorls 4; the spire is exserted and blunt; surface smooth, colour pale green and ochraceous.

Major diam. 10·5, axis (not height) 5·5 mm. Another specimen measures $13 \times 10\frac{1}{2} \times 7$ mm.

Hab. Tinnevelly Hills, Travancore.

Animal like *S. dekhanensis*. The lingual ribbon consists of about 68 rows, each of about 350 to 400 . 1 . 350 to 400 teeth, very closely packed. The rhachidian tooth is small, unicuspid; lateral teeth long, uniform, and terminally bicuspid, the outermost being serrated on the outer side below the bicuspid apex. Jaw leathery, as in *S. dekhanensis*.

These South-Indian species are most nearly allied to the Andaman *S. christianæ*.

332. **Satiella flexilis**, sp. n.

Shell imperforate, subglobosely depressed, very soft and flexible, scarcely retaining its shape, smooth, moderately polished, diaphanous, pale greenish; spire low, but apex slightly prominent, blunt, suture shallow; whorls $4\frac{1}{2}$, convex, the last rounded at the

periphery, slightly tumid beneath; aperture oblique, lunately semiovate; peristome thin, upper margin slightly arcuate, columellar curved, subvertical above.

Major diam. 13, min. 10½, height about 6½ mm.

Hab. Nilgiri Hills (*Beddome*). A shell from Sispara Ghat, collected by myself, is apparently the same.

This is more tumid than *S. pertenuis* or *S. levidensis* and is even thinner and more flexible. It can easily be recognized by its greenish colour.

333. **Satiella compressa**, sp. n.

Shell imperforate, depressed, thin, membranaceous, slightly flexible, smooth, with obsolete transverse striation, pale rufescent brown; spire very low, conoidal, apex subacute, suture scarcely impressed. Whorls 4½, flatly convex above, the last bluntly subangulate at the periphery, somewhat flattened beneath; aperture oblique, lunately and subangulately ovate; peristome thin, upper margin arcuate, columellar oblique.

Major diam. 17¼, min. 14½, height 6½ mm.

Hab. Tirrhiot Ghat, Wynaad.

This is easily recognized by its large size and compressed shape.

334. **Satiella pertenuis**, sp. n.

Shell imperforate, depressed, very thin, submembranaceous, smooth, not highly polished, pale yellowish brown; spire scarcely raised, but apex prominent, papillar; suture shallow; whorls 5, at first closely wound, then increasing more rapidly, flatly convex, the last subangulate above the periphery, then rounded, more tumid beneath; aperture oblique, lunately ovate; peristome thin, columellar margin obliquely curved, finally vertical above.

Major diam. 15½, min. 12½, height about 6½ mm.

Hab. Wynaad (*Beddome*).

This is considerably larger than *S. levidensis* and with an additional whorl. The last whorl, too, is broader.

*335. **Satiella membranacea**, *Bs.* (Vitrina) *A. M. N. H.* (2) xii, 1853, p. 93; *Pfr.* (Vitrina) *Mon. Hel.* iv, 1859, p. 792; *H. & T.* (Vitrina) *C. I.* 1876, pl. 152, fig. 10.

"Shell much depressed, submembranaceous, obsoletely obliquely striated, striæ very close towards the apex, pellucid, greenish horny, polished, slightly convex above, apex flattened, suture scarcely marginate; whorls 3½, rapidly increasing, the last broad in front, flattened beneath, rounded at the narrow periphery; aperture oblique, ovate, the upper margin arcuate forwards.

"Major diam. 11, min. 8, height 4 mm." (*Benson*, in Latin.)

Hab. Balcadua (apparently a pass of this name), Ceylon.

I have not seen this shell, which is evidently an ally of *S. dekhanensis*, but much more depressed.

Genus SITALA.

Sitala, *H. Adams, P. Z. S.* 1865, p. 408.
Conulema, *Stoliczka, J. A. S. B.* 1871, 2, p. 236.
Sitala, *Godwin-Austen, Mol. Ind.* i, 1882, p. 25.

Type, *S. infula*, Bs.

Range. Indo-Malay Region.

"Shell conoidal, thin, consisting of many, usually spirally-ribbed or striated whorls; base convex, narrowly or indistinctly umbilicated; margin of the aperture thin, not expanded; outer simple." (*Stoliczka.*)

Typical examples of the genus are more or less trochiform and horny, and, as a rule, surrounded by spiral costulation. A large number of small species may belong either to this genus or to *Kaliella*, or possibly to other forms. As a rule, those referred to *Sitala* are distinguished by spiral sculpture, sometimes very fine and only visible under a microscope. But in some cases the characters of the radula, despite the presence of spiral sculpture, have caused the species to be referred to *Kaliella*.

"Animal (of typical species) narrow, long (generally equal to twice the greater diameter of the shell); pedicles long, tentacles much shorter; lateral line (peripodial groove) distinct, the margin beneath it smooth; gland at the end of foot large, superseded by a distinct horn; sole grooved; two shell- and two dorsal lobes to the mantle, all of them small and with no separately produced appendages, but slightly extended on either end; genital organs with or without an amatorial gland; a simple appendix to the penis, produced into the penis retractor; receptaculum seminis (spermatheca) terminating with a bulging end, bedded in the posterior portion of the oviduct and prostata. Jaw thin, transparent, smooth, indistinctly or finely concentrically striated in the middle. Radula large, consisting of numerous (above 100) transverse rows, each with very numerous (300 to above 400) teeth, a very few median teeth being conspicuously larger than the laterals, which are narrow, pectiniform, and very gradually decreasing in width." (*Stoliczka.*)

Unfortunately the animal of only two species (*infula* and *attegia*) has been examined. These differ in the presence or absence of a dart-sac or amatorial organ.

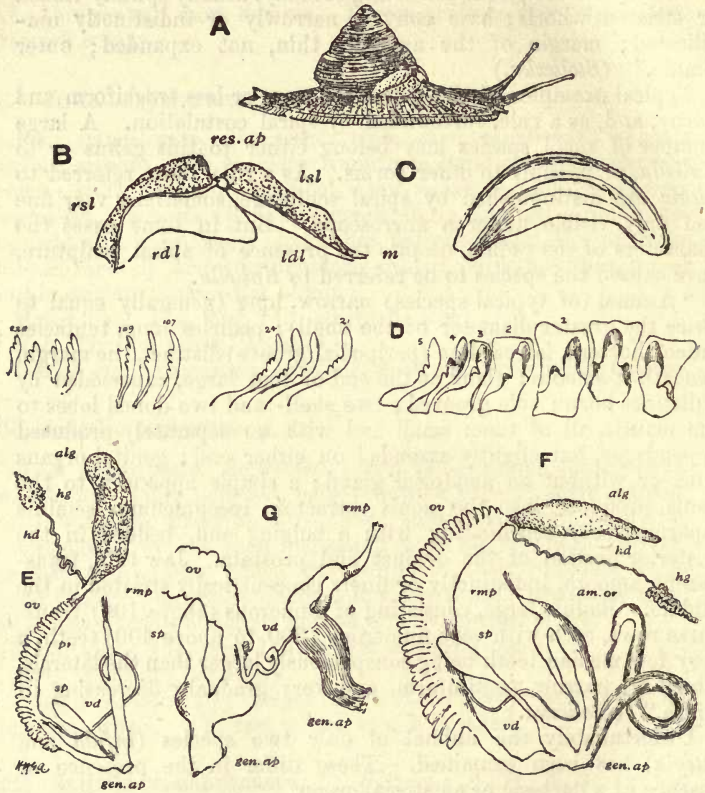
A. *Typical, subtrochiform or turbinate, spirally ribbed.*

a. *Columella slightly reflected.*

336. **Sitala infula,** *Bs.* (Helix) *A. M. N. H.* (2) ii, 1848, p. 160; *Pfr.* (Helix) *Mon. Hel.* iii, 1853, p. 58; *id.* vii, 1876, p. 103; *Stoliczka* (Conulema), *J. A. S. B.* 1871, 2, p. 239, pl. 18, figs. 5–9 (shell, animal, and anatomy); 1873, 2, p. 16, footnote; *H. & T.* (Helix) *C. I.* 1876, pl. 54, fig. 9; *Nevill,* Nanina (Sitala), *Hand-l.* i, 1878, p. 33; *Godwin-Austen, Mol. Ind.* i, 1882, p. 26, pl. 8, figs. 1-1*f* (shell, animal, and anatomy).

Helix turbiniformis, *Bs. J. A. S. B.* vii, 1838, p. 218 (no description): *nec Pfr.* 1839.

Shell subperforate, subtrochiform, thin, not polished above, faintly striated obliquely, with longitudinal (spiral) raised lines often obsolete on the lower whorls, and finer ribbing intercalated between them, translucent, greyish horny; spire conical, suture



[Fig. 78.—*Sitala infula.*

A. Animal from life (after Stoliczka).
B. Mantle-zone, showing shell- and dorsal lobes (after Stoliczka). Enlarged.
C. Jaw. × 30.
D. Teeth of radula. × 475.
E. Generative organs (after Stoliczka). Enlarged.

Sitala attegia.

F. Generative organs (after Stoliczka).

Sitala vulcania.

G. Part of the generative organs. × 3·4.]

impressed; whorls 6, convex, the last angulate, the angulation disappearing near the mouth, base slightly convex, smoother, marked with radiating striæ and impressed subdistant concentric lines; aperture subquadrately lunate, very little oblique; peristome simple, straight, columellar margin subvertical, becoming vertical above, and slightly reflected.

Major diam. 7½, min. 7, height 7 mm.

Hab. Throughout Bengal and Orissa. Recorded from Calcutta, Murshidebad, Raniganj, Rajmehal Hills, Patharghatta in Behar, and Talchir in Orissa. Specimens from the last named have 7 whorls, and measure 8 mm. in major diameter and 7½ in height. Nevill includes specimens from Arakan, Bassein, and Moulmein in Burma. Shells are also said to have been found at Poona and in parts of Southern India, but this requires confirmation.

Animal leaden grey with a pinkish tinge, spotted and striped darker. No dart-sac. The vas deferens joins the male organ on the distal side of the retractor muscle, being slightly expanded near the penis, but without kalc-sac or other appendix, and there is a distinct cæcum to the muscular attachment.

Jaw finely striated, arched, scarcely projecting in the middle. Radula containing 150 . 3 . 1 . 3 . 150 (*Stol.*)—120 . 3 . 1 . 3 . 120 (*G.-A.*)—teeth in each row, about 100 rows being present; the *seven* median teeth are conspicuously larger than the others and bicuspid, the laterals pointed with 2–5 cusps on the outer side.

337. **Sitala attegia**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 184; *Theobald* (Helix), *J. A. S. B.* xxvi, 1857, p. 250; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 91; *id. t. c.* vii, 1876, p. 104; *Stoliczka* (Conulema), *J. A. S. B.* 1871, 2, p. 237, pl. 18, figs. 1–4 (anatomy); *H. & T.* (Helix) *C. I.* 1876, pl. 86, figs. 6, 7; *Nevill*, Nanina (Sitala), *Hand-l.* i, 1878, p. 33; *Godwin-Austen*, *Mol. Ind.* i, 1882, p. 29, pl. 8, figs. 2–2*f* (shell and anatomy).

Shell narrowly perforate, subtrochiform, thin, obliquely striated, and with longitudinal (spiral) subdistant raised lines, stronger on upper whorls, with minute flexuous striation interposed (the latter only seen under a microscope), translucent, pale yellowish or brownish horny; spire conical, suture impressed; whorls 7–7½, convex, slowly increasing, the last carinate, convex beneath, radiately striate, and marked with distant concentric impressed lines; aperture oblique, subquadrately lunate; peristome thin, straight, columellar margin vertical, broadly triangularly reflected, partly covering the perforation.

Major diam. 10, min. 9, height 9 mm. Some specimens are 12½ mm. in diameter and 10½ high; others are as small as 6 mm. in diameter.

Hab. Throughout Pegu and Tenasserim, and in Upper Burma, also being found at Bhamo, according to Nevill. Recorded also from Ava, Prome, Akouktoung, Moulmein, Ataran Valley, Phiethan, Tenasserim Valley, Mergui, and, according to Nevill, Preparis

Island. Specimens have also been received from the Andamans (var. *cadelli*, Nev. MS.) and the Nicobars.

The shell in this species varies much; some are thin and horny with the spiral ribbing almost obsolete, in other cases the shells are thicker and the ribbing strong throughout. From *S. infula* it is distinguished by more open perforation and by lower spire. It is also, as a rule, much larger, with more numerous whorls.

Animal dull whitish, ridge of posterior part of foot grey, mantle-lobes light or sometimes pinkish grey, inner part of mantle with spots and stripes of dark pigment. The dart-sac is present and consists of a strong, tough, twisted tube; spermatheca club-shaped, swollen at the end, then narrowing to a tube, and again swollen near the orifice; *vas deferens* short and thin, expanding before joining the penis, which is connected with the retractor muscle by a long cæcum. Jaw semicircular, scarcely projecting in the middle of the concave edge. Teeth of radula 200 . 2 . 1 . 2 . 200, in about 100 rows, middle tooth long, tricuspid? (too many cusps are represented in Stoliczka's figure; he probably made the drawing by eye and not with a sufficiently powerful microscope), the next two broader, but passing into the narrower admedian, having one cusp in the outer edge; the marginals are serrated on the outer edge.

[338. **Sitala vulcania**, sp. n.

Locality. Narkondam Island, Bay of Bengal (*G. Rogers*, Oct. 1904).

It is interesting to find this genus on this small volcanic cone, lying some 85 miles east of the North Andaman Island. I have compared it with *S. attegia*, var. *cadelli*, Nev. MS., from the S. Andamans. There is considerable difference in form; the Narkondam shell is more sharply keeled than *cadelli* or typical *attegia*, and the whorls are more convex, the spire less high. Considerable difference is found in the sculpture: in the Andaman *S. cadelli* there is very fine irregular striation on the last whorl, with very regular distinct liration on the apical whorls; in the other, *vulcania*, there is coarse irregular striation on the last whorl, indistinct liration on the apical whorls, with slight indication of same on the basal side. The animal was in a very good state of preservation. Foot divided, the usual peripodial grooves, and broad fringe below. Head darkish grey, also keel of foot. There is a very minute right shell-lobe.

The generative organs agree very well with Stoliczka's description and figure of *Sitala infula*, Bs. The penis and spermatheca are exactly the same, and the amatorial organ is absent, as in that species.

The radula I was fortunate in extracting complete; it is very broad, having a large number of teeth in one row, the formula being

$$\begin{matrix} 210 \,.\, 2 \,.\, 1 \,.\, 2 \,.\, 210 \\ 212 \,.\, 1 \,.\, 212 \end{matrix}$$

It is also curious to find that this radula is almost the counterpart of *Sitala attegia*, as described by Stoliczka (*vide* J. A. S. B. vol. xl, 1871, pt. 2, p. 238), but Stoliczka's figures of the teeth of this genus are very misleading.]

339. **Sitala culmen**, *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 72; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 94; *Godwin-Austen, Mol. Ind.* i, 1882, p. 31, pl. 8, fig. 4 (shell).

Shell very minutely perforate, trochiform, thin, pale brownish horny, translucent, obliquely striated, and with fine raised, rather distant, spiral lines, closer together near the base of each whorl; 8 or 9 may be counted on the lower whorls, some stronger than others; spire conical, apex obtuse, suture impressed; whorls 6, convex, the last sharply keeled at the periphery, slightly convex beneath, marked with radiating striæ and fine concentric impressed lines; aperture slightly oblique, subquadrately lunate; peristome simple, thin, columellar margin vertical, triangularly reflected.

Major diam. $5\frac{2}{3}$, min. $5\frac{1}{3}$, height $5\frac{1}{2}$ mm.

Hab. Pegu, Akouktoung on Irrawady River, and banks of Hsanda Hyoung, west of Henzada.

Stoliczka referred this shell to *S. attegia*, and Nevill to *S. infula*. It is distinguished, however, both by smaller size, higher spire, and stronger sculpture.

340. **Sitala confinis**, *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 71; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 83; *H. & T.* (Helix) *C. I.* 1876, pl. 159, fig. 8; *Godwin-Austen, Mol. Ind.* i, 1882, p. 32, pl. 10, fig. 2 (shell).

Shell narrowly perforate, subtrochiform, thin, marked with 3 to 4 distant spiral ribs on each whorl, and obliquely striated, whitish horny; spire conical, with the sides flat, apex slightly obtuse, suture impressed. Whorls $7–7\frac{1}{2}$, the upper slightly convex, the lower nearly flat, last whorl sharply keeled, convex beneath, and finely radiately striated; aperture slightly oblique, subquadrately lunate; peristome thin, straight, columellar margin subvertical, triangularly reflexed.

Major diam. $10\frac{1}{2}$, min. $9\frac{1}{2}$, height 9 mm.

Hab. Thayet Myo and Ava; Burma.

From *infula*, *attegia*, and *culmen* this species is distinguished by stronger sculpture, and from *arx* by the sides of the spire being straight, not concave.

341. **Sitala arx**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 184; *Theob.* (Helix) *J. A. S. B.* 1857, p. 250; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 90; *H. & T.* (Helix) *C. I.* 1876, pl. 54, fig. 8.

Shell narrowly perforate, conical, thin, faintly obliquely striated, and each whorl surrounded by about 4 strong, raised, thread-like ribs, smooth beneath, translucent, pale brownish horny; spire conoidal, the sides considerably concave, suture scarcely impressed,

apex acute; whorls $7\frac{1}{2}$, the upper somewhat convex, the lower flat, the last acutely keeled, slightly convex beneath; aperture oblique, subtrapezoidal; peristome straight, thin, columellar margin slightly oblique, triangularly reflected.

Major diam. 10, min. 9, height 8 mm.

Hab. Therapuin or Therapon Hill, Tenasserim Valley.

Distinguished from all allied forms by the concave sides of the spire and the strong spiral costulation.

342. **Sitala palmaria**, *Bs.* (Helix) *A. M. N. H.* (3) xiii, 1864, p. 137; *Pfr. Mon. Hel.* v, 1868, p. 75; *H. & T.* (Helix) *C. I.* 1876, pl. 30, figs. 5, 6; *Godwin-Austen, Mol. Ind.* i, 1882, p. 35, pl. 10, fig. 3.

Shell perforate, subturbinate, marked with spiral ridges, 5 or 6 on the lowest whorl, 4 on the next higher, and with fine oblique regular raised lines above, smooth with radiating striæ beneath, whitish horny; spire conoid, with convex sides, apex obtuse, smooth, suture impressed; whorls $5\frac{1}{2}$, convex, the last carinate, moderately convex beneath; aperture oblique, angularly lunate; peristome thin, straight, columellar margin broadly expanded above.

Major diam. 7, min. $6\frac{3}{4}$, height 5 mm.

Hab. Nundydroog, in Mysore (*Benson*), and Wynaad (*Beddome*).

The above is taken from a typical specimen fully grown received from Benson. The original type had $6\frac{1}{2}$ whorls and 7 spiral ribs and measured $8\frac{1}{2} \times 8 \times 6$ mm.

343. **Sitala liricincta**, *Stoliczka* (Conulema), *J. A. S. B.* 1871, 2, p. 241, pl. 18, fig. 10; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 104; *H. & T.* (Helix) *C. I.* 1876, pl. 132, fig. 7; *Nevill*, Nanina (Sitala), *Hand-l.* i, 1878, p. 34; *Godwin-Austen, Mol. Ind.* i, 1882, p. 34.

Shell subobtectly and minutely perforate, turbinate, spirally lirate, with about 4 strong ribs on each whorl, 5 or 6 on the lowest whorl, smoother on the base, with a few concentric raised lines near the periphery, ochraceous horny; spire conical, sides slightly convex, apex obtuse, suture impressed; whorls $6\frac{1}{2}$, convex, the last with a sharp rib representing a keel, but not distinctly angulate, convex beneath; aperture nearly vertical, almost semicircularly lunate; peristome thin, columellar margin slightly oblique, almost vertical and reflected, with a slight projection in front of the perforation.

Major diam. 6, min. $5\frac{2}{3}$, height 5 mm. (Stoliczka gives $6{\cdot}4 \times 6 \times 5{\cdot}8$.)

Hab. On the banks of the Ataran River, near Moulmein.

Near *S. palmaria*, but the spiral ribs are more distant and stronger, the last whorl is less distinctly keeled, the spire is higher, and the whorls more numerous. The animal has not been examined in either species.

The small projecting point of the reflected columellar margin of the peristome tends to recall that in *Microcystina*.

b. *Columella strongly reflected, thickened, and twisted.*

344. **Sitala? gratulator**, *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 72; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 94; *H. & T.* (Helix) *C. I.* 1876, pl. 16, fig. 2; *Nevill*, Nanina (Sitala), *Hand-l.* i, 1878, p. 33; *Godwin-Austen, Mol. Ind.* i, 1882, p. 42, pl. 10, figs. 1, 1 *a*, 1 *b* (shell).

Shell perforate, trochiform, not very thin, obliquely striated and ornamented with strong spiral (longitudinal) raised lines above and more finely concentrically lined and radiately striate beneath, pale brownish horny; about 6 or 7 ribs on last whorl; spire conical, apex obtuse, suture impressed; whorls $5\frac{1}{2}$, slowly and regularly increasing, convex, the last carinate at the periphery, flatly convex beneath; aperture diagonal, subtrapezoidal, breadth exceeding height; peristome thin, margins united by a callus, basal sinuate, columellar forming a right angle with basal, reflected and thickened above and passing half round the perforation.

Major diam. 5, min. 4·5, height 4 mm.

Hab. Irrawady Valley, Pegu. Common about Thayet Myo, also at Akouktoung and Henzada.

The animal has a small mucous pore at the posterior end of the foot, and a small lobe overhanging the mucous pore. The eye-tentacles are long. These characters agree with those of *S. infula*. The very oblique mouth and twisted columella, however, may point to generic differences.

B. *Small shells of doubtful affinity, all under 6 mm. in diameter.*

a. *Carinate, subperforate or narrowly perforate.*

345. **Sitala gromatica**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 32, pl. 10, fig. 5 (shell).

Shell subperforate, pyramidal, trochiform, obliquely striated and spirally ribbed, with about 10 fine, thread-like, subdistant raised lines, closer together below near the suture, umber-brown; spire conical, sides nearly flat, suture shallow; whorls 7, convex, the last carinate at periphery, lower surface slightly convex, radiately and concentrically striated; aperture oblique, subquadrately lunate; peristome thin, columellar margin oblique, reflected.

Major diam. $3\frac{1}{2}$, height 3 mm.

Hab. Manipur, North Cachar, and Khasi Hills.

346. **Sitala haroldi**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 33, pl. 10, fig. 7 (shell); *id. t. c.* ii, 1898, p. 47; *id. P. Z. S.* 1895, p. 448.

Shell subperforate, trochiform, finely spirally lirate, about 10 spiral lines on the lower whorls, radiately and concentrically striate on the base, brownish horny; spire conical, sides flat, suture

shallow; whorls 7, slightly convex, the last carinate; nearly flat beneath; aperture oblique, subrhomboidal; peristome thin, columellar margin oblique, forming an angle with basal.

Diam. 3½, height 3 mm.

Hab. Andaman Islands; South Andaman and Little Brother Island; also said to have been found on Katchall in the Nicobars.

A small distinctly trochiform shell with fine spiral sculpture.

[This is the species unnamed, *Nanina* (*Microcystis*), No. 200, p. 41, Nevill, Hand-l. i, and probably No. 208, p. 42.]

347. **Sitala ? phyllophila**, *Bs.* (Helix) *A. M. N. H.* (3) xi, 1863, p. 320; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 86; *H. & T.* (Helix) *C. I.* 1876, pl. 61, fig. 10; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 41.

"Shell scarcely perforate, trochiform, thin, silky above, obliquely striated, polished beneath, under the microscope ornamented, both above and below, with minute, close, undulating spiral striation, translucent, pale horny; spire conical, apex rather sharp, suture somewhat impressed; whorls 6½, convex, the last carinate; aperture oblique, subquadrately lunate; peristome simple, straight, sharp, columellar margin vertical, reflected, broader above, partly covering the perforation.

"Major diam. 5, min. 4½, axis 5 mm." (*Benson*, in Latin.)

Hab. Badulla and Kandy, Ceylon.

This is near *S. infula*, but distinguished by the closely-set undulate striæ instead of subremote spiral lines.

348. **Sitala ? pyramidalis**, *Sykes, Proc. Mal. Soc.* iii, 1898, p. 70, pl. 5, figs. 19, 20.

"Shell narrowly but perspectively umbilicated, small, depressedly pyramidal, pale horny, slightly covered with an epidermis, apex rather obtuse; whorls 7, plano-convex, the first smooth, the others spirally ribbed, the last with 4 to 6 ribs, keeled at the periphery, convex at the base, radiately striated, smooth; suture impressed, aperture angularly lunate; peristome simple, straight.

"Diam. 5, height 3·4 mm." (*Sykes*, in Latin.)

Hab. Lower Ambagamuwa, Ceylon (*Collett*).

349. **Sitala ? operiens**, *Sykes, Proc. Mal. Soc.* iii, 1898, p. 70, pl. 5, fig. 12.

Shell narrowly perforate, very small, elevately conoid, brownish horny, covered with a brown epidermis, apex rather acute; whorls 6, beneath the epidermis microscopically engraved with numerous spiral lines, the last keeled at the periphery, subconvex at the base, radiately striated, smooth; suture subimpressed; aperture ovately lunate; peristome simple, straight, columellar margin slightly reflected at the perforation.

"Diam. 2·5, height 2·5 mm." (*Sykes*, in Latin.)

Hab. Uva Pussellawa, Ceylon (*H. Preston*).

"The sculpture is not visible until the periostracum has been rubbed off."

b. *Carinate and umbilicated.*

350. **Sitala? balliana,** *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1882, p. 74, pl. 15, fig. 2 (shell); ii, 1898, p. 48.

Shell umbilicated, trochiform, obliquely, finely, regularly striated, spirally costulate, with 4 to 5 strong ribs on each whorl, umber-brown; spire conical, not high, apex blunt, sides slightly convex, suture impressed; whorls 5, convex, the last with a raised keel, slightly convex beneath; aperture subquadrangular, oblique; peristome slightly thickened, columellar margin oblique, becoming vertical above, slightly reflected.

Diam. 3½, height 2½ mm.

Hab. Hills near Ganjam, Madras Presidency (*Ball*).

[This is No. 193, *Nanina* (*Microcystis*), n. sp., Nev. Hand-l. i, 1878, p. 41, type.]

c. *Rounded or subangulate.*

351. **Sitala? phulongensis,** *Godwin-Austen, Mol. Ind.* i, 1882, p. 34, pl. 10, fig. 4 (shell); *id.* ii, 1898, p. 48.

Shell narrowly perforate, elongately conical, subturreted, spirally lirate, with 6 to 7 longitudinal ribs on each whorl, obliquely striated, with radiating and close concentric striation on the base, brownish horny; spire rather high, conical, sides slightly convex, suture impressed; whorls 5½, convex, the last not distinctly carinate, convex beneath; aperture oblique, almost semicircular; peristome thin, columellar margin vertical, slightly reflected.

Diam. 2, height 2·25 mm.

Hab. Khasi Hills, Cherra Pungi, and Phulong.

This is higher in the spire than most of its allies. The lingual ribbon resembles that of *Durgella*; it has a minute rhachidian tooth and a great number of multicuspid laterals, all similar; the jaw, too, is almost straight.

[*S. infula* and *attegia* approach *Durgella* in the form of the lateral teeth, only they have from 7 to 5 central teeth on broad plates.]

352. **Sitala? limata,** *Godwin-Austen, Mol. Ind.* i, 1882, p. 34, pl. 10, fig. 9 (shell).

Shell subperforate, elongately subtrochiform, finely spirally lirate, having about 6 longitudinal ribs on last whorl, closely concentrically striated on base, brownish horny; spire conical, sides convex, apex blunt, suture slightly impressed; whorls 5, convex, the last not carinate, convex beneath; aperture vertical, subquadrately semicircular; peristome thin, columellar margin vertical, slightly thickened and reflected.

Major diam. 1½, height 1¾ mm.

Hab. Thamandeva, base of Arakan Range, Bassein District, Pegu (*W. T. Blanford*).

353. **Sitala? subnana**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1882, p. 75, pl. 14, fig. 6 (shell).

Shell subperforate, conoid, obliquely striated and decussated by fine, rather close, impressed spiral (longitudinal) lines, pale brown; spire conical, rather low, apex obtuse, suture impressed; whorls $4\frac{1}{2}$, convex, the last subangulate, flatly convex beneath; aperture oblique, semilunate; peristome thin, columellar margin slightly oblique and reflected.

Diam. $2\frac{1}{2}$, height $1\frac{3}{4}$ mm.

Hab. Jessore in Bengal.

A small, low conoid shell, subangulate at the periphery.

354. **Sitala? crenicincta**, *Godwin-Austen*, *Mol. Ind.* i, 1883, p. 75, pl. 13, fig. 2 (shell), p. 145, pl. 38, figs. 4, 4 *a* (teeth of radula).

Shell perforate, depressedly turbinate, thin, obliquely striated and decussated with fine, rather close impressed lines both above and below, brownish horny; when fresh with two spiral parallel rows of fine hairs; spire conoidal, apex obtuse, suture well impressed; whorls 4, convex, the last rounded at the periphery; aperture oblique, semiovately lunate; peristome thin, columellar margin vertical.

Diam. 2·25, height 1·5 mm. A larger variety from Mairang measures 2·7 by 1·75 mm.

[The radula is very similar to that of *Kaliella barrakporensis*, but the outer laterals are not tricuspid. The centre tooth is very large, tricuspid, pointed, broad and long; the admedian teeth are bicuspid, the outer cusp near the base, while in the outermost 3 or 4 it nearly disappears. Few teeth in the row. Formula: 18 to 20 . 5 . 1 . 5 . 18 to 20, or 25 . 1 . 25. A variety, slightly larger and very narrowly perforate, from wood at Mairang, Khasi Hills.]

Hab. Khasi, Jaintia, and Naga Hills; Marangsip Peak, Jawai, Teria Ghat, Shillong, &c. (*Godwin-Austen*).

The close impressed lines give the idea of raised ribs between them, especially on the upper whorls.

355. **Sitala? injussa**, *W. & H. Blf.* (Helix) *J. A. S. B.* 1861, xxx, p. 356, pl. 1, fig. 13; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 81; *H. & T.* (Helix) *C. I.* 1876, pl. 132, figs. 5, 6; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 38; *Godwin-Austen*, *Mol. Ind.* i, 1882, p. 38, pl. 9, fig. 5.

Shell subperforate, angulately turbinate, thin, marked with rather close, slightly wavy, impressed lines above and below, only visible under a microscope, crossed by fine oblique striæ of growth, brownish horny; spire conical, suture impressed; whorls $5\frac{1}{2}$, slightly convex, the last angulate at the periphery, moderately convex beneath, the angulation disappearing near the mouth; aperture oblique, subquadrately lunate; peristome simple, straight, margins converging, columellar vertical, moderately triangularly reflected.

Major diam. 4, min. $3\frac{2}{3}$, height $3\frac{1}{2}$ mm.

Hab. Coonoor Ghat, Nilgiris, and the Wynaad. From the latter some specimens measure about $4\frac{1}{2}$ mm. in diameter.

This shell is somewhat like *Macrochlamys rimicola*.

356. **Sitala? srimani**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 41, pl. 9, fig. 7 (shell).

Shell minutely perforate, depressedly turbinate, coarsely obliquely striated, with 4 or 5 indistinct spiral (longitudinal) ribs, concentrically ribbed beneath, brown horny; spire conoid, apex blunt, suture well impressed; whorls 5, convex, the last rounded; aperture lunate; columellar margin of peristome oblique, slightly reflected.

Diam. $2\frac{1}{4}$, height $1\frac{1}{2}$ mm.

Hab. Manipur.

*357. **Sitala? placita**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 74, pl. 14, fig. 3 (shell).

"Shell, perforation concealed, globosely conoid; sculpture, distant longitudinal ribbing, on the base far apart and well raised; colour pale horny; spire rather high, conic, apex blunt, suture impressed; whorls $4\frac{1}{2}$, convex, last well rounded on periphery; aperture ovate or semicircular; columellar margin suboblique.

"Major diam. 2·8, alt. axis 2 mm." (*Godwin-Austen.*)

Hab. Khasi Hills and Manipur, one specimen from each locality (*Godwin-Austen*).

The measurements of the figure are: maj. diam. 3, height 1·7 mm.

The shell in its form resembles *S.? srimani*, but is not so flat at the base.

358. **Sitala? intonsa**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 75, pl. 13, fig. 1 (shell).

Shell narrowly umbilicated, depressedly turbinate, obliquely striated, and decussated by close, finely impressed, longitudinal (spiral) lines above and below, closer on apical whorls, wider on the base, yellowish brown; spire conoid, apex obtuse, suture well impressed; whorls 5, rounded, the last whorl broader, rounded at the periphery and below; aperture oblique, semiovate; peristome straight, columellar margin oblique, slightly reflected.

Diam. $3\frac{1}{2}$, height $2\frac{1}{4}$ mm.

Hab. Marangsip Peak, Khasi Hills (*Godwin-Austen*).

Said to be hirsute when fresh.

359. **Sitala? uvida**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 74, pl. 13, fig. 5 (shell).

Shell narrowly umbilicated, depressedly turbinate, obliquely

striated, the striation decussated by close, finely impressed, longitudinal spiral lines above and below, yellowish brown; spire conoid, apex obtuse, suture deep; whorls 5, rounded, slowly increasing in size, the last rounded at the periphery and beneath; aperture oblique, diagonal, semiovate; peristome straight, columellar margin oblique, slightly reflected.

Diam. $2\frac{3}{4}$, height $1\frac{3}{4}$ mm.

Hab. Teria Ghat, Khasi Hills and Jatinga Valley, North Cachar Hills (*Godwin-Austen*).

Near *S. srimani*, but the spiral sculpture is different and much finer, the shape of the aperture, too, differs considerably.

360. **Sitala? recondita**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 75, pl. 13, fig. 4 (shell).

Shell narrowly and subobtectly perforate, depressedly turbinate, obliquely subcostulate above, on the base finely and closely marked with impressed concentric lines, pale brownish horny; spire conoid, low, apex blunt, suture well impressed; whorls $4\frac{1}{2}$, convex, the last subangulate at the periphery, convex beneath; aperture oblique, roundly lunate; peristome thin, columellar margin oblique, slightly reflected.

Diam. $2\frac{1}{2}$, height $1\frac{3}{4}$ mm.

Hab. Raliang, North Jaintia Hills; Jawai, Khasi Hills (*Godwin-Austen*).

The sculpture is peculiar, oblique, and subcostulate above, concentric only below.

d. *Longitudinally striated.*

361. **Sitala? rimicola**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 266; *Pfr.* (Helix) *Mon. Hel.* v. 1868, p. 71; *H. & T.* (Helix) *C. I.* 1870, pl. 61, fig. 1; *Godwin-Austen* (Sitala), *Mol. Ind.* i, 1882, p. 36, pl. 9, figs. 2, 3, & 4 (shells from Mussoorie, Darjiling, and Khasi Hills); ii, 1898, p. 48.

Shell subperforate, turbinate, globosely conical, thin, fragile, finely obliquely striated and decussated, with close very fine longitudinal impressed lines above and below, translucent, pale brownish horny; spire conical, apex obtuse, suture impressed; whorls 6, convex, the last larger, rounded (sometimes subangulate) at periphery, convex beneath; aperture oblique, semicircularly lunate; peristome thin, straight, columellar margin vertical, reflected.

Major diam. $4\frac{1}{2}$, min. 4, height 4 mm.

Hab. Landour and Nag Tiba range near Mussoorie in Western Himalayas; Darjiling 4000′, and various places in the Anghami and Lhota Naga, Khasi, and Garo Hills south of Assam; Durrang, Assam. Specimens from Sikhim are subangulate; those from Khasi Hills rather larger, from 5 to $5\frac{1}{2}$ mm. in diameter.

[Dr. Blanford placed this species in *Macrochlamys* with doubt; I retain it in *Sitala*. The animal is unknown.]

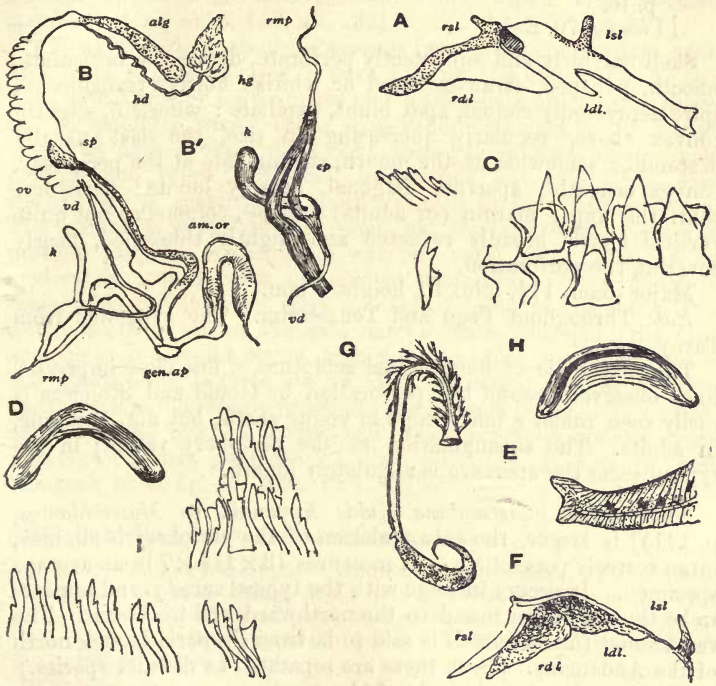
[The species *honesta* was included in *Macrochlamys* by Dr. Blanford (*vide* p. 121). I have placed it in a new genus, *Sakiella*, following Stoliczka, who considered it sufficiently distinct to put it in the genus *Durgella*, the anatomy of the type of which, *levicula*, was not then known and which differs materially.]

[Genus SAKIELLA.

Type, *S. honesta*.

Range. Pegu and Tenasserim.

Differs from *Macrochlamys* in the form of the teeth of the radula and the formula, the number of the teeth in the row being



[Fig. 79.—*Holkeion anceps.*

A. Mantle-zone removed, showing shell- and dorsal lobes. (After Stoliczka.)
B. The generative organs. (After Stoliczka.)
B'. The male organ, × 18. From a Mergui specimen (G.-A.).
C. Teeth of the radula, × 270. Ditto.
D. Jaw, × 18. Ditto.

Sakiella honesta.

E. Extremity of foot. From Muleit range, near Moulmein.
F. Mantle-zone, part of, showing shell- and dorsal lobes. Ditto.
G. A spermatophore. From a specimen from Burmah assigned to *honesta*, more probably that of *M. andersoniana*, Nevill. (After Stoliczka.)
H. Jaw. From a Muleit specimen.
I. Teeth of the radula. From two Muleit specimens.]

three times as numerous. The shell has the aperture peculiarly oblique. The shell-lobes are as in *Macrochlamys*. The genitalia have not been satisfactorily worked out, owing to lack of material properly preserved.]

362. **Sakiella honesta**, *Gould* (Helix), *Proc. Bost. Soc. N. H.* ii, 1846, p. 99; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 57; *id. t. c.* iv, 1859, p. 63; *id. t. c.* vii, 1876, p. 19; *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 87; *Stol.* Macrochlamys (Durgella), *J. A. S. B.* 1871, p. 248, pl. 17, figs. 6 & 6 *a*; *H. & T.* (Helix) *C. I.* 1876, pl. 90, fig. 10; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 24; *Godwin-Austen*, *Mol. Ind.* i, 1883, p. 142, pl. 19, figs. 7–7 *b* (details of animal); *v. Mart.* Nanina (Durgella), *Jour. Linn. Soc.* xxi, 1889, p. 162.

[*Vide* fig. 79, E–I.]

Shell narrowly and subobtectly perforate, depressed, orbiculate, smooth, polished, straw-coloured or whitish horny, translucent; spire depressedly conoid, apex blunt, papillate; whorls 5, slightly convex above, regularly increasing in size, the last usually descending somewhat at the mouth, subangulate at the periphery, convex beneath; aperture diagonal, broadly lunate; peristome thin, the upper margin (in adults) arcuate, columellar not quite vertical above, broadly reflected and slightly thickened, nearly covering the perforation.

Major diam. 11½, min. 10, height 6 mm.

Hab. Throughout Pegu and Tenasserim. The type was from Tavoy.

The concentric or longitudinal sculpture of fine close impressed lines observed around the perforation by Gould and Stoliczka is easily seen under a microscope in young shells, but not, as a rule, in adults. The subangulation at the periphery varies; in the typical form the aperture is angulately lunate.

Nevill's var. *andersoniana* [(*vide* Appendix to *Macrochlamys*, p. 141)] is larger, the subangulation of the periphery is slighter, often scarcely perceptible. It measures 13 × 11½ × 7 in an average specimen. It occurs in Pegu with the typical variety, and appears to be the only form found to the northward and in Assam. The var. *tenuior* (undescribed) is said to be from Preparis Island, north of the Andamans. [Both these are separated as distinct species.]

The genitalia are said to be of the usual type, and the spermatophore, figured by Stoliczka, is long, terminating at one end in a trumpet-shaped aperture, and at the other in a sac, and furnished near the former end with horny branching appendages. The jaw is narrow and smooth, with (or, as shown in Godwin-Austen's figure [this was of *S. honesta*], without) an obtuse median projection. The radula has about 23 broad teeth in the middle, with 30 to 35 narrow laterals (30 . 11 . 1 . 11 . 30); the middle tooth tricuspid, the admedian becoming bicuspid, the outer laterals bicuspid with the points directed outwards. [All this refers to *Macrochlamys andersoniana* (*vide* p. 141).]

[From Stoliczka's description (J. A. S. B. 1871, p. 249):—

"The animal of the Moulmein variety is narrow, very long, pale white, pedicles and the termination of the tentacles leaden grey, as well as the upper part of the foot posteriorly; the tail-gland is superseded by a very distinct hook; the mantle-lobes are well developed, both the upper portions being reflected over the shell. By some accident, however, my spirit-specimens were lost and I am, therefore, unable at present to give sufficient details regarding the anatomy of this species."

The descriptions which follow at the bottom of pp. 249 & 250 refer to the animal, anatomy, spermatophore, jaw, and radula of a species from Burma collected by Dr. Anderson, evidently *Macrochlamys honesta*, var. *andersoniana*, Nev., which is a distinct species (*vide suprà*, p. 141, no. 192).

The animal (three species observed) from Mule-it Mountain near Moulmein is pale-coloured, a dark line on the upper side of the foot, with three or four conspicuous black spots on the side above the peripodial grooves; these spots when extended in life would appear as dark streaks. The right shell-lobe is long, narrow, and pointed, and there is a small tongue-like left shell-lobe. The visceral sac is spotted, the spots arranged in four parallel rows. The genitalia were not well seen, but the amatorial organ was present and the spermatheca was not very long. The jaw is moderately arched, with no median projection. The radula is remarkable for the very large number of teeth in the row. The centre tooth is on an elongate narrow plate, tricuspid; the first admedians on similar plates, with a single small cusp much below the points; the laterals are all alike, becoming smaller towards the margin and unevenly bicuspid; the formula being 153 . 1 . 153, or 307 in the row. The jaw and radula are quite distinct from Stoliczka's figures on plate 17, figs. 10 & 14, J. A. S. B., and Semper's pl. 5, fig. 20, Reis. Phil. 1870.]

[363. **Sakiella? tenuior**, *Godwin-Austen*; *Nevill, MS.*

Macrochlamys honesta, *var.* tenuior, *Godwin-Austen, P. Z. S.* 1895, pp. 441, 446; *Nevill, MS.*; *id. Hand-list*, i, 1878, p. 24, 16th line from bottom of page, var. of *honesta*. (8. Moulmein (type var.), coll. Dr. F. Stoliczka and W. Theobald; 6. Preparis Island, coll. Stoliczka.)

These shells are in the Indian Museum, Calcutta, and I have not been able to see them.]

[Genus **HOLKEION**.

Type, *H. anceps*, Gould.

Range. Upper Burma, Moulmein, Mergui, and Northern Siam.

Stoliczka places *anceps* in the genus *Rotula*, not considering it sufficiently like *Macrochlamys* to leave it in that genus. The shell differs very much in character, being sharply carinated at the periphery; the whorls numerous, narrow, flattened, and

sculptured above, smooth and polished on base; narrowly or not perforated. Although possessing shell-lobes, the position of the right shell-lobe is below the inner upper angle of the peristome, and plays only over the lower surface of the shell—a position different from that in *Macrochlamys*. The animal has a very hooked lobe above the mucous pore.

The differences between this genus and *Macrochlamys* are shown in the description of the animal of *H. anceps* below.]

364. **Holkeion anceps,** *Gould* (Caracolla), *Bost. Jour. N. H.* iv, 1844, p. 454, pl. 24, fig. 4; *Pfr.* (Helix) *Mon. Hel.* i, 1847, p. 80; *H. & T.* (Helix) *C. I.* 1876, pl. 30, fig. 1; *Stol.* (Rotula) *J. A. S. B.* 1871, 2, p. 233, pl. 17, figs. 1–3 (anatomy); *v. Mart.* Nanina (Rotularia), *Jour. Linn. Soc.* xxi, 1889, p. 161; *Godwin-Austen, Proc. Mal. Soc.* ii, 1897, p. 174.
[*Vide* fig. 79, A–D, p. 237.]

Shell scarcely perforate, lenticular, sharply keeled, pale horny, dull and obliquely plicately striated above, polished and with fine radiating striation beneath, no longitudinal sculpture; spire low, conoidal, suture not impressed, bordered by a more or less distinct line inside; whorls 6, almost flat above, increasing slowly, the last

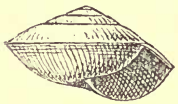


Fig. 80.—*Holkeion anceps.*

very little broader than the penultimate, convex beneath, compressed beneath the keel; aperture slightly oblique, angulately lunate; peristome thin, basal margin faintly arcuate, columellar oblique, briefly reflected above.

Major diam. 16, min. 14½, height 7½ mm.

Hab. Tenasserim; Mergui, Tavoy, and Moulmein; also Sullivan Island, Mergui Archipelago, and Northern Siam.

[Found generally on trees and bushes (*Stoliczka*).]

Animal dark grey with a distinct greenish tinge. Sole divided longitudinally into three tracts, that in the middle broader than the others. Tail-gland with slightly thickened edges and a small hook-like appendage above. The left shell-lobe (fig. 79, A) has below the angular periphery a lingulate process, reflected over the basal part of the peristome, and ends with another shorter process near the shell-retractor; the right shell-lobe has a lingulate process next to the pulmonary opening, and another broader one covering the columellar lip. Dorsal lobe well developed. Genitalia (B, B′) rather peculiar; the dart-sac or amatorial organ is very thick and provided with a strong pointed papilla. Spermatheca very long and slender. *Vas deferens* leading to a kalc-sac, which gives off an elongate flagellar appendage close to the junction and leads to the bend of the penis, to which the retractor muscle is attached.

There is no trace of the coiled cæcum found in typical forms of *Macrochlamys*.

The jaw (D) is rather angularly semilunar, smooth, very concave in the middle. Radula of about 75 rows, with about 135 teeth in a row (55 . 12 . 1 . 12 . 55): the median and admedian rows tricuspid and broad, with the middle cusps prolonged; laterals bicuspid, curved outwards and very pointed. These details are taken from Stoliczka's description, [which is very accurate, but the teeth of the radula are not well drawn].

[Specimens from Mergui sent me by Mr. Theobold which I have dissected confirm Ferdinand Stoliczka's descriptions, with the exception of the radula, in which the median teeth are quite plain and straight-sided, without any trace of the usual cusps, the outer teeth being bicuspid.]

365. **Holkeion arata**, *Blf.* Nanina (Rotula), *P. Z. S.* 1869, p. 448; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 302; *H. & T.* (Helix) *C. I.* 1876, pl. 84, figs. 8, 9, 10; *Nevill*, Nanina (Rotula), *J. A. S. B.* 1877, 2, p. 15.

Similar to *H. anceps*, but much larger, and with considerably stronger plicate oblique sculpture above and radiating striæ beneath, not polished below; whorls 7, slightly convex above, the last rather less swollen beneath than in *H. anceps* and somewhat more sunken around the perforation.

Major diam. 22, min. 20, height 10 mm. Some specimens are even larger.

Hab. Bhamo, Upper Burma. A smaller variety was obtained at Ponsee in Yunnan [var. *minor* of Blanford].

Genus **SESARA**.

Sesara, *Albers, Heliceen*, ed. 2, 1860, p. 91; *Stoliczka, J. A. S. B.* 1871, 2, p. 242.

Type, *S. infrendens*, Gould. [Fig. 81, D–D 2, p. 242.]

Range. From the Khasi Hills to Burma and Tavoy, also Western Siam.

"Shell perforate or imperforate, conoidly depressed, turbinate or trochiform; typical forms transversely costulale or costulately striated above, smooth and polished below. Several of the species have teeth in the aperture.

"Animal (of *S. infrendens* and *S. pylaica*) long and with a narrow foot; the terminal gland distinct, and a small hooked and pointed appendage above it. The sole has two longitudinal grooves, rather close together, the median portion narrower than each of the outer parts. The mantle-edge is nearly entire; the left shell-lobe is below internally considerably thickened, the left dorsal lobe is very small or almost obsolete; the right shell-lobe thin and somewhat convex, but without separate appendage." (*Stoliczka.*)

Genitalia (from Stoliczka's description) (fig. 81, D). The re-

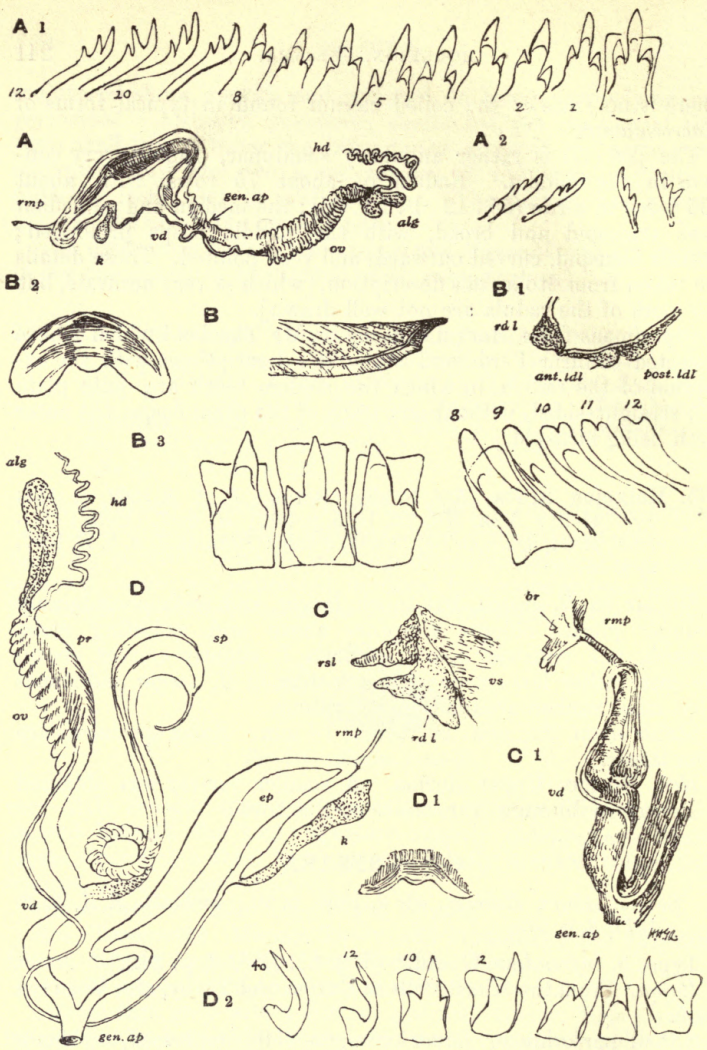


Fig. 81.—*Kaliella barrakporensis.*

A. Foot of the genitalia. × 9. A 2. Outermost laterals. × 938.
A 1. Teeth of the radula. × 938.

Microcystina rinki.

B. Extremity of the foot. × 6. B 2. Jaw. × 38.
B 1. Mantle-edge with dorsal lobes. B 3. Teeth of the radula. × 908.

Microcystina bintennensis.

C. Right edge of the mantle, right shell- and dorsal lobes. × 18.
C 1. The male organ. × 18.

Sesara infrendens.

D. The genitalia (after Stoliczka), much enlarged. Spermatophores within the spermatheca.
D 1. Jaw. D 2. Teeth of the radula.

tractor muscle is attached to the penis some distance (the length of the epiphallus) beyond the junction of the vas deferens, which enters at the base of an appendage corresponding with the kalc-sac (*k*); this sac is about equal in length to the distance between the junction of the vas deferens and the retractor muscle. No cæcum of the penis. A very long spermatheca, in which three spermatophores of the type usually seen in *Macrochlamys* and its allies were found. No dart-sac.

The jaw (D 1) is narrowed, smooth, with an obtuse projection in the middle of the concave side. The radula (D 2) is composed of about 60 transverse series, with the approximate formula: 50 . 10 . 1 . 10 . 50. Median tooth small, without lateral cusps, the ten laterals on each side larger than the median tooth, those near the median tooth bicuspid, having a large outer cusp, those towards the exterior tricuspid; outer laterals bicuspid, with an outer denticle near the base, which disappears in the narrow marginal teeth.

All the species referred to this generic group are of small size. It is an open question whether *S. diplodon* and its allies should be included; they are arranged here provisionally until their animals are known. The shells of the typical form closely resemble those of North-American Helicidæ of the genus *Triodopsis*.

A. *Conoidly depressed or subturbinate, costulate or subcostulate above, imperforate or narrowly perforate.*

a. *Teeth in aperture.*

a'. *Three palatal teeth.*

366. **Sesara infrendens**, *Gould* (Helix), *Bost. Jour. N. H.* iv, 1844, p. 453, pl. 24, fig. 6; *Pfr. Mon. Hel.* i, 1848, p. 152; *id.* vii, 1876, p. 276; *Stoliczka, J. A. S. B.* 1871, p. 242, pl. 16, figs. 4–10 (anatomy); *Pfeffer, JB. mal. Ges.* v, 1878, p. 272; *id. Arch. d. Naturgesch.* xliv, 1878, p. 425, pl. 13, fig. 10.

Helix capessens, *Bs. A. M. N. H.* (2) xviii, 1856, p. 250; *Pfr. Mon. Hel.* iv, 1859, p. 194; *id.* vii, 1876, p. 306; *H. & T. C. I.* 1876, pl. 60, fig. 5.

Helix tickelli, *Theobald, J. A. S. B.* xxviii, 1859, p. 306; *H. & T. C. I.* 1876, pl. 15, fig. 3.

[Fig. 81, D–D 2.]

Shell imperforate, depressedly conoid, tawny, arcuately costulate above, the ribbing passing over the periphery and gradually disappearing below. Spire conoid with convex sides, suture impressed; whorls 7, convex, slowing increasing, the last more or less angulated or carinate at the periphery, or sometimes rounded, moderately convex beneath, slightly hollow in the middle; aperture slightly oblique, narrow, with three teeth on the basal margin; peristome slightly thickened, basal margin arcuate.

Major diam. 10, min. 9, axis 5 mm.

Hab. Moulmein and Tavoy.

This shell varies in height of spire, in the roundness or carination of the periphery, and in the teeth. Usually the latter are subequal and nearly equidistant, the middle one being often nearer

to the outer than to the inner. In the variety *tickelli* the middle and outer teeth are close together and united at the base; this form is also rather small and sharply keeled. In *capessens*, which is also keeled and somewhat depressed (Benson's three measurements are 9, 8, and 4 mm.), the teeth are equidistant.

367. **Sesara hungerfordiana,** *Theobald, J. A. S. B.* 1876, p. 184, pl. 14, fig. 1.

Shell imperforate, depressed, sublenticular, pale yellowish horny, finely, closely, and costulately striated above, the ribbing passing over the keel and disappearing on the lower surface, the interior portion of which is smooth and polished; spire low, suture scarcely impressed; whorls 6, flattened above, slowly increasing, the last descending for about one-third of its course, sharply and compressedly keeled, moderately convex beneath, excavated in the middle, the keel finely serrated; aperture very slightly oblique, elongate, margins diverging, joined by a callus; peristome thickened inside, the basal margin arcuate and bearing three subequal and equidistant teeth, the two outer united by a low lamella, the thickening inside the upper and columellar margins also lamelliform.

Major diam. 11¼, min. 11, axis 5 mm.

Hab. Mizantoung on the Salwin, near Moulmein.

Distinguished by its lenticular form, sharp keel, and descending last whorl.

b'. *Palatal teeth* 2.

368. **Sesara ataranensis,** *Theobald* (Nanina), *J. A. S. B.* 1870, p. 401, pl. 17, fig. 7; *Pfr. Mon. Hel.* vii, 1876, p. 578; *H. & T. C. I.* 1876, pl. 84, figs. 5, 6.

Shell imperforate, lenticular, pale chestnut or tawny, costulately striated above, the striation conspicuously more distant on the outer whorls, closer on the inner, and wanting on the innermost; spire convexly conoid, suture not impressed; whorls 7, almost flat above, the last with a compressed keel, moderately convex beneath, the costulate striation passing below the keel and disappearing gradually on the lower surface, which towards the middle is excavated and polished; aperture nearly vertical, angulate externally, narrow and contracted by lamellæ, one in the upper margin increasing in height externally and joining by its base a second, large and almost semicircular, concave in front, which occupied half the basal margin, a third smaller and re-entering, nearer the columellar area; peristome white, thickened inside, basal margin arcuate.

Major diam. 9, min. 8½, axis 4 mm.

Hab. Banks of Ataran River, not far from Moulmein.

Distinguished from *S. infrendens* by finer sculpture, a sharp keel, and very different dentition.

369. **Sesara mouleyitensis**, *Gude, Jour. Mal.* viii, 1901, p. 15.

Nearly allied to *S. ataranensis*, and having a similar aperture and the same teeth, but larger, conoidly depressed instead of lenticular, and with rounded periphery; basal margin of peristome strongly arcuate, and periomphalus much excavated, whilst the last whorl descends beneath penultimate as in *S. hungerfordiana*.

Major diam. 10, height 5¾ mm.

Hab. Muleyit, almost due east of Moulmein.

370. **Sesara bidentifera**, *Godwin-Austen* (*W. T. Blanford, MS.*).

Shell imperforate, depressedly conoid, rather solid, yellowish tawny, arcuately and costulately striated above, the striæ passing below the periphery and disappearing on the lower surface, which is smooth and polished; spire conoid with convex sides, suture impressed; whorls 7, increasing slowly, almost flat, scarcely convex, the last bluntly keeled at the periphery, convex beneath, excavated in the middle; aperture oblique, trapezoidal, with its margins diverging; peristome with white labiations inside, the basal margin arcuate, armed with two subequal teeth, columellar margin oblique, slightly expanded.

Major diam. 8, min. 7½, axis 5 mm.

Hab. Muleyit, west of Moulmien, at 4000 feet elevation (*Limborg*).

A small form with two simple palatal teeth.

c'. *A single palatal tooth and a columellar fold.*

371. **Sesara ? episema**, *Ponsonby, Proc. Mal. Soc.* i, 1894, p. 56, figs.

Shell imperforate, conoidly depressed, thin, brownish horny, subarcuately and costulately striated above, the riblets (sharp and rather irregular) passing over the periphery; lower surface, except near periphery, smooth, polished, radiately striated; spire low, conoid, with convex sides, suture impressed; whorls 7, convex, closely wound, the last bluntly angulate at the periphery, convex beneath, excavated in middle; aperture oblique, almost a rhomboid, with a conical tooth in the middle of the basal margin, and a re-entering spiral lamina on the columellar; peristome white, obtuse, columellar margin oblique, scarcely reflected.

Major diam. 17½, min. 16, axis 9½ mm.

Hab. Hills South of Assam, precise locality doubtful; Asalu, in Western Naga Hills?

b. *Aperture contracted by a parietal and a palatal lamella.*

372. **Sesara pylaica**, *Bs.* (Helix) *A. M. N. H.* (2) xviii, 1856, p. 249, (3) iv, 1859, p. 95 (animal); *Pfr. Mon. Hel.* iv, 1859, p. 164; *id. t. c.* vii, 1876, p. 268; *Stoliczka, J. A. S. B.* 1871, 2, p. 245; *H. & T. C. I.* 1876, pl. 15, fig. 2.

Shell imperforate, conoidly depressed, rather solid, tawny whitish on the periomphalus below, transversely costulate, the ribbing disappearing at the apex, and also on the whitish portion of the lower surface, though continued below the periphery; spire low, conoid, suture impressed; whorls 7–7½, narrow, the last descending a little close to the aperture, subangulate to angulate at the periphery, convex beneath, slightly hollow in the middle; aperture oblique, narrow, curved, contracted by a thick parietal lamella, and by another palatal inside the peristome, extending from its external angle to its columellar insertion; peristome white, thickened.

Major diam. 9, min. 8, axis 5 mm.

Hab. Farm Caves, Moulmein.

A shell with a remarkable aperture, resembling that of the North-American *Helix hirsuta*?

The foot is very narrow, the posterior portion especially so, and it is truncated behind. There is a small mucous pore and a small lobe above it. The mantle-lobes are short, not extending over the surface of the shell. Upper tentacles long, lower short.

c. *Aperture edentulous.*

373. **Sesara helicifera**, *W. T. Blanford* (Nanina), *J. A. S. B.* 1865, p. 68; *Pfr. Mon. Hel.* v, 1868, p. 241; *H. & T. C. I.* 1876, pl. 50, figs. 3, 4.

Shell imperforate when adult, but with a deep umbilical hollow, perforate in the young, turbinate, rather thin, horny, fulvous, finely, closely, subarcuately, and obliquely costulate above, the costulation passing over the periphery and merging into radiating striations on the lower surface, which is smooth and polished; spire conoid with convex sides, apex obtuse, suture impressed; whorls 7½, closely wound, convex above, the last angulate at the periphery (keeled in the young), flatly convex beneath, with one or more irregular indentations, mostly opaque white from internal callus, at a distance of half a whorl from the mouth; aperture oblique lunate, about twice as broad as high, with a spiral lamina on the columellar margin, extending into the whorls; peristome simple, basal margin slightly arcuate, columellar oblique.

Major diam. 10, min. 9, axis 7 mm.

Hab. Arakan Range west of Prome, Burma.

Animal dark above, almost black, sole paler. Mucous pore very small, but with a lobe above.

374. **Sesara mamillaris**, *W. T. Blanford* (Nanina), *J. A. S. B.* 1865, p. 69; *Pfr. Mon. Hel.* v, 1868, p. 88; *H. & T. C. I.* 1876, pl. 50, figs. 1, 2; *Nevill, Hand-l.* i, 1878, p. 54.

Similar to *S. helicifera*, except that the base is perforate and the columellar lamina and indentations on the lower surface are wanting in adults, though they are found in young shells, also

that the spire is lower and the apex slightly acuminate, the base flatter and the periphery of the basal whorl keeled.

Major diam. 10½, min. 10, axis 6½ mm.

Hab. Akoutoung, south of Prome, Pegu (*W. T. B.*), and Arakan Hills (*Kurz*).

The animal has a small mucous pore and small projecting lobe above it.

375. **Sesara basseinensis**, *W. T. Blanford* (Nanina), *J. A. S. B.* 1865, p. 70; *Pfr. Mon. Hel.* v, 1868, p. 89; *H. & T. C. I.* 1876, pl. 30, fig. 7.

Similar to *S. helicifera*, but perforate, with a less excavated umbilical region and without any spiral fold on the columellar margin or indentations on the lower surface. Distinguished from *S. mamillaris* by higher spire, non-acuminate apex, rounded base, and more rounded periphery.

Major diam. 11, min. 10, axis 8 mm.

Hab. Southern part of Arakan Range in Bassein district of Pegu.

B. *Depressed, carinate, smooth, edentulous.*

376. **Sesara? inermis**, *Theobald, J. A. S. B.* 1876, 2, p. 184, pl. 14, fig. 2.

Shell minutely perforate, depressed, sublenticular, amber-coloured, horny, smooth, polished, finely obliquely striated above, subobsoletely and radiately beneath; spire very low, suture impressed; whorls 6½, convex, the outer whorls flattened externally, the last not descending, striately and compressedly keeled, moderately convex below; aperture nearly vertical, rather narrow, sharply angulate at the periphery, without teeth; peristome white, thickened inside, basal margin strongly arcuate, columellar rather sharply curved and vertical at its insertion, scarcely reflected.

Major diam. nearly 12, min. nearly 11, axis 5 mm.

Hab. Salwin Valley, near Moulmein.

A species of somewhat doubtful affinities.

C. *Trochiform, smooth, imperforate or narrowly perforate.*

a. *A palatal tooth present.*

377. **Sesara? diplodon**, *Bens.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 187; *Pfr. Mon. Hel.* v, 1868, p. 256; *H. & T. C. I.* 1876, pl. 60, fig. 8; *Godwin-Austen, J. A. S. B.* 1876, 2, p. 312; *Nevill, J. A. S. B.* 1877, 2, p. 17; *id. Hand-l.* i, 1878, p. 53 (pt.).

Shell minutely perforate, trochiform, thin, smooth, finely striated and decussated with close microscopic spiral lines throughout, polished beneath, pale horny; spire almost conical, varying

in height, the sides slightly convex, apex rather obtuse, suture slightly impressed, distinctly marginate; whorls 7, increasing slowly, convex, the last not descending, sharply and filiformly keeled, moderately convex below the keel, impressed in the umbilical region, raised into a slightly compressed longitudinal ridge, with a hollow outside it near the basal margin of the peristome; aperture oblique, trapezoidal, with three palatal teeth, the inner subcolumellar, small and conical, the outer lamellar, entering deeply and curved, the portion near the peristome and the innermost portion higher in general than the intervening part; peristome white, obtuse, sharply angulate at the periphery and less sharply in the middle of the arcuate basal margin, columellar margin straight, oblique.

Major diam. $6\frac{1}{4}$, min. $5\frac{3}{4}$, axis 5 mm.

Hab. Dafla Hills and Hill-ranges south of Assam at low elevations, Chittagong.

The relative distribution of this and of the next two species is not well known, but one or the other is found from Assam and Yunnan to Pegu, the Little Cocos Is., and Preparis.

The shell varies in size and in the height of the spire.

378. **Sesara ? harmeri,** *Gude, Jour. Mal.* vii, 1900, p. 139, figs. 1, 2.

Similar to *S.* ? *diplodon*, but distinguished by having the basal surface simply convex behind the aperture, not pinched up into a ridge in the middle, and hollow near the periphery; also in having the outer palatal tooth much shorter and simple, without the inner raised portion.

[Major diam. 6·75, min. 6·25, alt. 5 mm., of shell described.]

Hab. Khasi Hills.

379. **Sesara ? ingrami,** *Blf.* (Helix) *H. & T. C. I.* 1876, pl. 60, figs. 9, 10; *Blf. J. A. S. B.* 1880, p. 193.
Nanina (Sesara) diplodon, *Nevill, Hand-l.* i, 1878, p. 53, pt.

Very similar to *S.* ? *diplodon*, but imperforate and with three palatal teeth, all lamellar. Two are close to the peristome, that on the columellar side is small and runs obliquely inwards; the outer is in the middle of the basal margin, where it begins as a thickening inside the lip, then it is sharply curved and passes towards the interior of the whorls; the third is behind the second, it is curved and transversely placed at some distance within the aperture: all are visible through the shell beneath.

Major diam. $6\frac{1}{2}$, min. 6, alt. $4\frac{1}{2}$ mm.

Hab. Arakan Range and probably Pegu.

The animal has a small mucous pore with a small lobe above it, not quite at the end of the foot, which is flattened posteriorly.

b. *Aperture without teeth.*

380. **Sesara? galea**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 388; *Pfr. Mon. Hel.* v, 1868, p. 264; *H. & T. C. I.* 1876, pl. 54, fig. 7.

? Sesara harmeri, *var.* anodonta, *Gude, Jour. Mal.* vii, 1900, p. 140, figs. 5, 6.

This species also closely resembles *S.* ? *diplodon*, but the aperture is edentulous and the base flatter; the spire, too, is rather lower.

Major diam. (according to Benson) nearly 9, min. 8, axis 5½ mm.

Hab. Teria Ghat, Khasi Hills.

The shell called *S.* ? *harmeri*, var. *anodonta*, has a descending last whorl near the mouth, whilst *H. galea* was described as having the last whorl not descending; the spire, too, in the latter is lower: but it appears probable that the two are identical.

[Genus **RAHULA.**

Rahula, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 216, pl. 117.

Type, *R. macropleuris*, Bs.

Range. Eastern Himalaya; Khasi and Naga Hills; and Arakan.

Shell elongately pyramidal or conically trochiform; basal side flat, deeply umbilicated, subangulate around the umbilicus; apex pointed or rounded; costulation strong, close or distant, more or less absent on the apical whorls. Whorls 6–8, more or less carinate on the keel of the last.]

[381. **Rahula macropleuris**, *Bs.*

Helix macropleuris, *Bs. A. M. N. H.* (3) iii, 1859, p. 265; *Pfr. Mon. Hel.* v, 1868, p. 183; *H. & T. C. I.* 1876, p. 37, pl. 87, fig. 10; *Godwin-Austen, Mol. Ind.* ii, 1907, p. 216, pl. 103, fig. 1 (shell).

Kaliella (sec. B) macropleuris, *Theob. Suppl. Cat.* p. 20.

Nanina (Microcystis ?) macropleuris, *Nevill, Hand-l.* i, 1878, p. 42.

Hab. Rissom Peak, 6410 ft.

Shell figured in Mol. Ind.

Major diam. 3·75, alt. 4·75–5·8 mm.

Original description:—"*Testa subaperte umbilicata, attenuato-pyramidata, oblique minute arcuato-striata, superne costis remotis elevatis arcuatis munita, decorticata, albida, nitidula; spira pyramidali, superne attenuata, apice papillari, papilla lœviori, sutura carinato-marginata; anfractibus* 8, *convexiusculis, ultimo non descendente, filoso-carinato, subtus planulato, versus aperturam convexiusculo, circa umbilicum profundissimum, anguste perspectivum, angulato; apertura obliqua?, transversa, quadrata, peristomate tenui, recto, margine columellari lato, expansiusculo.*

"Diam. major 5, minor 4½, long. 5½ mill.

"Habitat in valle Rungun [Rungnu], prope Darjiling, rarissime.

"This shell is an exaggeration of the *bascauda* type of the Khasia Hills, with a more remote costulation and lengthened attenuate spire. The aperture of the single dead specimen collected by Mr. W. T. Blanford is not in the best condition."

Several specimens of this pretty species occur among the shells collected by Mr. W. Robert in the hills east of the Teesta River also an allied form from Damsang.]

[Benson described a species as allied to *macropleuris*, viz. *H. corys*. This single dead specimen I find is in the Blanford Collection, which he presented by will to the Natural History Museum. The specimen has suffered much since Benson described it, and it is

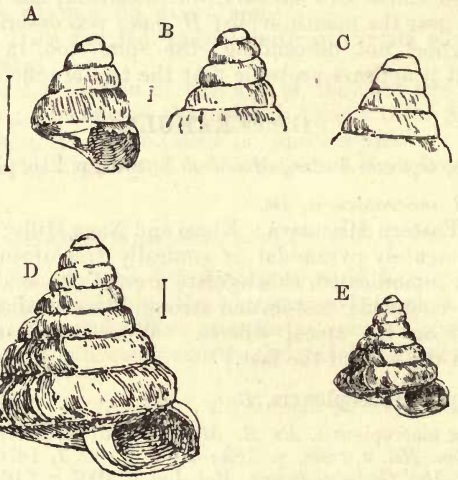


Fig. 82.

A. *Rahula corys*, Bs. Type. Young shell, × 9.
B. Apex of specimen No. 34, Blanford's Collection, named *macropleuris*, × 9.
C. Apex of *R. macropleuris*, Bs., × 9.
D. *R. corys*, Bs., Damsang, × 6.
E. Ditto, ditto, × 3.

now only 2 mm. in length; the aperture and last whorls gone. I give a drawing of this (fig. 82, A); also one of the apex of a true *macropleuris* and the Damsang specimen—the three enlarged to the same amount. I cannot see any appreciable difference between the apex of *corys* (fig. 82, A) and specimen No. 34 (fig. 82, B). The suture is marginate near the apex; the costulation at remote intervals does not begin until the fourth or fifth whorl. I refer this form to Benson's *H. corys*.

The apex of typical *macropleuris* (fig. 82, C), it will be seen, is distinctly filose at the suture, even at the third whorl; and the side of the spire is flatter, very different to fig. 82, A & B.

The shell from Damsang (fig. 82, D & E), which I consider *corys*, differs considerably in other characters from *macropleuris*. In this last the spire is pyramidal, with flat sides, as in pl. 103, fig. 1, Mol. Ind. ii.; in *corys* (fig. 82, D & E) the spire contracts more rapidly above the antepenultimate whorl, and the sides are decidedly concave. The distant costulation is stronger; the base is flatter; the columellar margin broader; the aperture is quadrate and smaller; while the umbilicus is also smaller (*vide* Benson's description, below).]

[382. **Rahula corys**, *Bs.*
Helix corys, *Bs. A. M. N. H.* iii, 1859, p. 265.
Kaliella (sec. B) corys, *Theob. Suppl. Cat.* p. 20.
Rahula corys, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 218, fig. 1 (type), fig. 4 (shell).

Original description:—"*Testa perforata, elongato-pyramidali, oblique confertim minutissime costulato-striata, albida, non nitente; spira anguste pyramidali, apice obtusiusculo, sutura impressa; anfractibus 5½, convexiusculis, ultimo ad peripheriam filoso-carinato, basi planiuscula; apertura obliqua?, quadrata, longitudine latitudinem æquante, peristomate tenui, recto, margine columellari verticali, longe vix expansiusculo.*

"Diam. 2, long. 3 mill.

"Habitat in valle Rungun [Rungnu], prope Darjiling, rarissime occurrens.

"A single dead specimen occurred to Mr. W. T. Blanford. This minute shell is of a type allied to the last-described species in form, but is very differently sculptured. Its more pointed, not papillate apex, and the absence of costulation at somewhat remote intervals, and of a marginate suture, through so many whorls, prove that it is not the young of *macropleuris*. From the clear horn-coloured *Helix fastigiata*, Hutton, of the Western Himalaya, it may be known by its narrower spire, decided sculpture, minute size, the absence of a marginate suture, and by its perforate base; and from the dark-coloured *H. barrakporensis*, Pfr., of the Sikkim Terai, by the first three characters."]

383. **Rahula bascauda**, *Bs.* (Helix) *A. M. N. H.* (3) iii. 1859, p. 186; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 256; *H. & T.* (Helix) *C. I.* 1876, pl. 16, fig. 1; *Nevill* (Nanina?), *Hand-l.* i, 1878, p. 42; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 218, pl. 117, figs. 1, 1 *a*, 3, 3 *a* (shells).]

Shell very deeply umbilicated, subtrochiformly conoid, ornamented with oblique rather distant raised ribs above, less raised, closer and flexuous below, rufous horny; spire conical, apex obtuse, suture well impressed; whorls 6½, convex, slowing increasing, the last not descending with a raised keel at the periphery, convex beneath, subangulate around the umbilicus; aperture

slightly oblique, very roundly lunate; peristome thin, columellar and part of the basal margin slightly expanded.

Major diam. 4, min. $3\frac{1}{2}$, height $3\frac{3}{4}$ mm.

Hab. Khasi, Jaintia, and Naga Hills.

The above measurements are from a Khasi Hill specimen.

Benson's type from Terai Ghat measured $4\frac{1}{2} \times 4 \times 4$ mm. This and the next two somewhat resemble *Khasiella hyba* (no. 254, p. 162).

384. **Rahula polypleuris**, *Blf.* (Helix) *J. A. S. B.* 1865, 2, p. 76; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 136.
Helix pachypleuris, *Pfr. Mon. Hel.* vii, 1876, p. 138; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 219, pl. 117, fig. 2].

This shell is very near *R. bascauda*, but the sculpture is finer and closer, though still regularly costulate ribbing, the spire is lower and the umbilicus rather more open.

Major diam. 4, minor $3\frac{3}{4}$, height 3.

Hab. Arakan Hills, Pegu.

A shell from the Jyntia Hills agrees better with this than with the Khasi *R. bascauda*. This is in favour of Nevill's view that the two are varieties of one form.

[385. **Rahula bascaudula**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 219, pl. 117, fig. 7 (shell).

Original description:—Shell very openly umbilicated, trochiform, flat on base, sharply keeled, with fine carination; sculpture very close fine costulation, oblique; colour chestnut-brown; spire conoid, apex rather blunt, sides very slightly convex; suture impressed. Whorls 6; aperture quadrate; peristome thin, angulate on lower outer margin, columellar margin subvertical.

Size: major diam. 4·50, alt. axis 3·0 mm.

Hab. Risett chu and Richila Peak, Daling District.

This shell is very close to that of *R. bascauda*; but placed side by side these differences are to be noted: a blunter spire, side of spire more convex, and principally in the umbilicus being very much wider.]

[386. **Rahula daflaensis**, *Godwin-Austen, Mol. Ind.* ii. 1907, p. 220, pl. 117, fig. 5 (shell).

Original description: — Shell deeply umbilicated, globosely conoid; sculpture distant, raised, oblique, sinuate costulation; colour pale sienna-brown; spire conic, sides slightly convex; suture moderately impressed. Whorls 7, convex, indistinctly angular at the periphery near aperture; aperture semiovate; peristome thin, the columellar margin scarcely thickened.

Size: major diam. 4·2, alt. axis 3·0 mm.

Hab. Dikrang Valley, Dafla Hills (*Godwin-Austen*).

This interesting form can at once be distinguished by the absence of the lirate keel of *R. bascauda* and its allies.]

[387. **Rahula lhotaensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 220, pl. 117, fig. 6 (shell).

Shell openly and deeply umbilicated, pyramidal, base very flat, sharply keeled and carinate; sculpture, costulation close and regular, oblique and sinuate, extending to the basal side; colour rich brown (burnt-sienna); spire conical, apex pointed, sides slightly convex; suture fairly impressed, with a thin liration. Whorls 7, slightly convex; aperture quadrate, oblique; peristome thin, angulate on the lower outer margin; columellar margin subvertical, not thickened, slightly reflected.

Size: major diam. 5·0, alt. axis 4·9 mm.

Hab. Lhota Naga Hills, Assam (*Chennell*).

This is a larger species than the type, and can be distinguished by the more pointed apex, pyramidal form, and very flat base, and the costulation is much closer and finer.]

[388. **Rahula munipurensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 220, pl. 117, fig. 4 (shell).

Original description:—Shell globosely conic, deeply umbilicated, rounded below the keel, the liration on which terminates at the penultimate whorl; sculpture distant, very strong and very regular costulation; colour pale grey, the ribbing showing bright brown; spire conoid, side nearly flat; apex rounded; suture impressed. Whorls 6, regular, sides very convex; aperture semicircular; peristome fairly thickened, columellar margin subvertical.

Size: major diam. 3·5, alt. axis 2·25 mm.

Hab. Manipur Hills, north-east of valley (*Godwin-Austen*).

This is a very distinct little species and the smallest of the genus. I have only found one specimen as yet among the minute Helices I collected in the Munipur Hills.]

Genus **MICROCYSTINA**.

Microcystina, *Mörch, Jour. Conchyl.* xxiv, 1876, p. 357; *Godwin-Austen Mol. Ind.* i, 1882, p. 11 (shells and anatomy); ii, 1899, p. 110.

Type, *M. rinki*, Mörch.

Range. The greater part of the Indo-Malayan Region, but within British Indian limits recorded only from the Andaman and Nicobar Islands, Ceylon, Southern India, and Western Bengal.

Shell thin, horny, depressed to globosely depressed, and only distinguished from *Macrochlamys* by having the columellar margin of the peristome more broadly reflected and furnished with a projecting angular process which covers the perforation partially or wholly. All Indian forms exhibit microscopic longitudinal striation.

Animal imperfectly known, somewhat similar to *Macrochlamys* as regards the right shell-lobes and mucous gland, with an

overhanging pointed process as in that genus. In the genitalia it differs from *Macrochlamys* in that the male organ is simple and the retractor muscle is attached without any cæcum. The dart-sac was observed in *M. rinki*, but not in *M. bintennensis*. In the former it was shorter than the spermatheca, which was an elongate sac.

Further detailed examination of the animal of the Andaman and Nicobar species is desirable.

A. *Species from Nicobar Islands.*

389. **Microcystina rinki**, *Mörch* (Nanina), *Journ. Conchyl.* xx, 1872, p. 311 ; xxiv, 1876, p. 356 ; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 142 ; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 39 ; *Godwin-Austen, Mol. Ind.* i, 1882, p. 12, pl. 3, figs. 1–7 (shell and anatomy).
[*Vide* fig. 81, B–B 3, p. 242.]

Shell very narrowly and obtectly perforate, convexly depressed, thin, smooth, highly polished, with fine, longitudinal, parallel, microscopical striation above and below ; brownish horny, rather paler and whitish beneath ; spire convexly conoid, suture impressed ; whorls 5, convex, the last descending slightly and gradually towards the mouth, rounded at the periphery, tumid beneath ; aperture oblique, lunate ; peristome thin, columellar margin oblique, thicker, and rather broadly reflected, with a salient angular process nearly closing the perforation.

Major diam. 5·5, min. 5, height 3·5 mm.

Hab. The Nicobar Islands. Recorded from Great Nicobar (*Mörch*), Little Nicobar (*Busch*), Katchal Camorta, Car Nicobar, and Teressa (*de Rœpstorff*).

In the animal the left dorsal lobe is in two parts. The dart-sac is present. The teeth on the radula are 35 to 40 . 2 . 7 . 1 7 . 2 . 35 to 40, or about 47 . 1 . 47 : the inner laterals broad, elongate, and sharp, each with one cusp on the outside, none inside ; outer laterals each with two terminal blunt cusps.

B. *Species from Andaman Islands.*

390. **Microcystina moerchiana**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1882, p. 13, pl. 3, fig. 9 (shell) ; ii. 1898, p. 47.
Microcystina hochstetteri, *Godwin-Austen, A. M. N. H.* (6) ii, 1888, p. 57.

Shell imperforate, conoidly depressed, thin smooth, highly polished, very finely and closely striated longitudinally beneath the microscope, brownish horny, paler beneath around the umbilical region ; spire conoidal, apex obtuse, suture almost flat, scarcely impressed ; whorls 5, slightly convex, the last not descending, rounded at periphery, rather tumid beneath ; aperture very slightly

oblique, rather broadly lunate; peristome thin, columellar margin broadly reflected, vertical for a short distance above, the salient process closing the perforation of the shell.

Major diam. 7¾, min. 7, height 4½ mm.

Hab. Kondul Island, Nicobar Group; north coast of Great Nicobar.

This is the largest species yet described from the Nicobar or Andaman Islands.

391. **Microcystina warnefordi,** *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1882, p. 13, pl. 3, figs. 8, 8 *a* (shell and sculpture); ii, 1898, p. 47; *id. P. Z. S.* 1895, p. 447.

Shell obtectly perforate (almost imperforate), depressed, thin, polished, smooth, with very fine, close, and regular, longitudinal, microscopic striation, umber-brown; spire low, conoidal, suture shallow; whorls 5, convex, the last rounded at periphery, convex beneath; aperture nearly vertical, lunate; peristome thin, columellar margin oblique, reflected, and with an angular projection which nearly closes the perforation.

Major diam. 4, min. 3¾, height 2 mm.

Hab. Port Blair and the Brothers, Andaman Islands.

"Jaw very curved, central projection well developed. Animal black, with well-developed right shell-lobe, and large lobe over the mucous gland." (*Godwin-Austen.*)

392. **Microcystina harrietensis,** *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1882, p. 13, pl. 3, figs. 11, 11 *a* (shell and sculpture).

Shell imperforate, subglobosely depressed, smooth, not highly polished, with longitudinal, distinct, rather distant striation throughout under the microscope, umber-brown; spire conoidal, convex at the sides, apex obtuse, suture impressed; whorls 5, convex, slightly increasing, the last not descending, rounded at periphery and beneath; aperture subvertical, lunate; peristome thin, reflected, with an angulate projecting process covering the perforation of the shell.

Major diam. 2·3, axis 1·3 mm.

Hab. Mount Harriet, Port Blair, S. Andaman Island.

393. **Microcystina stewarti,** *Blanford* (stuarti, *Godwin-Austen, MS.*), *P. Z. S.* 1904, ii, p. 446, pl. 25, fig. 16 (shell).

Shell imperforate or subperforate, convexly depressed, very thin, smooth, highly polished, with faint transverse lines of growth and very fine, parallel, not very close, longitudinal, microscopic striation above and below, yellowish brown; spire low, convexly conoid, suture scarcely impressed; whorls nearly 5, flatly convex above, the last not descending, rounded at the periphery, convex below; aperture oblique, lunate; peristome thin, columellar margin

oblique, reflected above into an angulate process that closes the perforation.

Major diam. 4½, min. 4, height 2½ mm.

Hab. Andaman Islands.

This form is near *M. rinki*, from the Nicobars, but it is smaller, rather thinner, more closely wound, and imperforate. The spiral sculpture is less strong and less regular.

[Named after General Sir Donald Stewart, at one time Governor of the Andaman Islands. *M. stuarti* was adopted by Blanford in error.]

C. *Species from Peninsular India and Ceylon.*

394. **Microcystina bintennensis.**

Microcystina perfucata, *var.* bintennensis, *Godwin-Austen, Mol. Ind.* ii, 1899, p. 110, pl. 92, figs. 3–3 *i* (shell and anatomy).

Microcystina perfucata, *Bs.*; *Godwin-Austen, t. c.* p. 110, pl. 92, fig. 4 (columella of shell): *nec* Helix perfucata, *Bs.*

[*Vide* fig. 81, C, C 1, p, 242.]

Shell obtectly perforate, depressed, translucent, polished, very finely, closely, and faintly spirally striated under the microscope, most distinctly on the upper whorls, rich deep brown; spire low, convexly conoidal, apex obtuse, suture shallow; whorls 4½–5½, convex, the last broader, rounded at the periphery, convex beneath; aperture oblique, elliptically lunate; peristome thin, in one plane, columellar margin oblique, slightly curved, reflected and angulately projecting above, partly covering the perforation.

Major diam. 6½, min. 5¾, height 3 mm.

Hab. Ceylon, Bintenne (*Collett*); Badulla, 2000′, Matale, 1800′ (*Collett*); Dumballa (*Collett*).

In the animal the mucous gland is linear, with the end of the foot projecting above it. Peripodial margin broad; sole divided. Right shell-lobe present; no left shell-lobe; left dorsal lobe in two separate flaps. Jaw with a large projection in the middle. Teeth 30 . 1 . 8 . 1 . 8 . 1 . 30 (39 . 1 . 39). Male organ a simple straight sheath tapering above to the retractor muscle, and apparently destitute of kalc-sac. According to the figure the vas deferens joins the penis on the distal side of the retractor muscle. [This is only apparent; the retractor muscle is very long and extends to the junction of the vas deferens.]

This cannot be the same as *Macrochlamys perfucata*, Bs., from Galle, though the two were united by Godwin-Austen. Benson's species has four closely-wound whorls, the aperture scarcely oblique, and the columellar margin vertical.

395. **Microcystina shevaroyana**, *W. T. Blanford, P. Z. S.* 1904, ii, p. 446, pl. 25, fig. 17.

Shell rather openly and perviously perforate, conoidly depressed, thin, translucent, amber-coloured, polished, with very minute, close, and rather flexuous longitudinal (concentric) striation above

and below; spire conoidal, slightly raised, suture impressed; whorls 6, convex above, the last rounded at the periphery, rather flatly convex beneath; aperture slightly oblique, rather broadly lunate; peristome thin, the upper and basal margins faintly arcuate, columellar oblique, obtuse, expanded and slightly reflected above, with a very slight salient angle, not always recognizable, near the perforation.

Major diam. 8¼, min. 7½, height 4 mm.

Hab. Shevaroy Hills, Madras Presidency (*Daly*).

Near *M. bintennensis*, but larger and distinguished by more open perforation, much paler colour, and more numerous whorls.

There is also much resemblance to *Macrochlamys vilipensa*, but that has only five whorls, and a differently-shaped aperture and columellar margin.

396. **Microcystina lita**, *Sykes, Proc. Mal. Soc.* iii, 1898, p. 70, pl. 5, figs. 10, 11; *Godwin-Austin, Mol. Ind.* ii, 1899, p. 111, pl. 92, figs. 1–1 *c* (shell and sculpture).

Shell narrowly and obtectly perforate, convexly depressed, thin, smooth, polished, under the microscope rather distantly striated with spiral (longitudinal) impressed lines above and below, pale tawny; spire convex, obtuse, suture impressed; whorls 4½, increasing regularly, the last rounded at the periphery and convex beneath; aperture slightly oblique, lunate; peristome thin, columellar margin vertical above, slightly reflected and thickened, with a small and blunt salient angle.

Diam. 3·4, height 2 mm.

Hab. Ambagamuwa (*Collett*).

*397. **Microcystina cryptomphalus**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i. 1882, p. 13, pl. iii, fig. 10 (shell and sculpture).

Shell perforate, conoidly depressed, flat on base, marked with fine, regular, parallel, spiral (longitudinal), impressed lines under the microscope, pale brown; spire conoidal; whorls 5, regularly increasing, aperture lunate; peristome thin, reflected and angulate at columellar margin.

Major diam. 3·1, axis 1·5. (Description chiefly copied from original.)

Hab. Pareshnath Hill, Western Bengal, 4480′.

Genus KALIELLA.

Kaliella, *Blf. A. M. N. H.* (3) xi, 1863, p. 83; *Stol. J. A. S. B.* xl 2, 1871, p. 237; *Godwin-Austen, Mol. Ind.* i, 1882, pp. 1–10, 19–24, 1883, pp. 68–73, 146; *id. t. c.* ii, 1907, pp. 174–177.

Type, *K. barrakporensis*, Pfr. [Fig. 81, A–A 2, p. 242.]

Range. Indo-Malay and Mascarene Regions.

Shell narrowly perforate or imperforate, conical and when

typical trochiform, small, thin, horny, as a rule obliquely subcostulate or striated, and not spirally above; whorls increasing slowly, the last very little larger; peristome thin.

The animal of only one species, *K. barrakporensis*, is known and this very imperfectly. It is much like that of *Sitala*, and has a distinct caudal gland with a lobe above it. There is, however, no dart-sac, and there is a pear-shaped kalc-sac at the junction of the vas deferens with the penis; no cæcum leads to the retractor muscle, which is attached to a fold. The spermatheca has not been described. The radula differs from that of *Sitala* in the small number of teeth in each row (67 in *K. barrakporensis*, against 307 in *S. infula* or 405 in *S. attegia*) and in the larger number of broad admedian teeth.

Unfortunately so few animals have been examined that the generic position of several species included in the genus must remain very doubtful; this is more especially the case with those allied to *K.* ? *nana*. It is quite uncertain whether several of the small forms attributed to *Sitala* should not be assigned to the present genus and *vice versâ*, nor can any line be drawn to discriminate between the small shells of those two genera and the smaller species included in *Macrochlamys*.

I. *Imperforate or narrowly perforate.*

A. *Trochiform, carinate at periphery.*

a. *Height and diameter nearly equal.*

398. **Kaliella barrakporensis**, *Pfr.* (Helix) *P. Z. S.* 1852, p. 156; *id.* (Helix) *Mon. Hel.* iii, 1853, p. 59; *id. t. c.* iv, 1859, p. 33; *id. t. c.* v, 1868, p. 86; *id. t. c.* vii, 1876, p. 100; *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 272; *W. & H. Blf. J. A. S. B.* xxx, 1861, p. 358; *Blf. A. M. N. H.* (3) xi, 1863, p. 83; *Stol. J. A. S. B.* xl, 2, 1871, p. 237; *H. & T.* (Helix) *C. I.* 1876, pl. 87, fig. 7; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 41; *Theobald, J. A. S. B.* 1878, 2, p. 142; *Godwin-Austen, Mol. Ind.* i, 1882, pp. 2, 19, pl. 1, figs. 1–4 (shell), pl. 2, fig. 1 (shell), pl. 5, fig. 11 (radula); 1883, p. 146, pl. 38, fig. 5 (genitalia).
Helix sivalensis, *Hutton, MS.*; *Bs. l. c.*; *Godwin-Austen, Mol. Ind.* i, 1882, pl. 1, figs. 3, 3 *a*, pl. 2, fig. 1 (shells).

Shell subperforate, pyramidally trochiform, thin, obliquely striated [or rather microscopically costulately ribbed] above, concentrically and fairly closely marked with impressed lines on the base, smooth, translucent, horny brown; spire conical, sides very slightly convex, suture impressed; whorls 6, convex, slowly increasing, the last keeled, not descending, slightly convex beneath; aperture oblique, subquadrately lunate; peristome simple, thin, straight; columellar margin slightly oblique, reflected, concealing perforation.

Diam. $3\frac{1}{2}$, height $3\frac{1}{2}$ according to Pfeiffer, but varying, and height often less than diameter.

Hab. Himalayas, Bengal, Deccan, S. India, Burma?, Ceylon, Madagascar. Localities recorded are: Kashmir (*Theobald*); Mussoorie, 7000 feet (*Godwin-Austen*); Doon below Landour (*Hutton*); Sikhim, Pankabari, and Rangnu valley (*W. T. Blanford*), and Titalya (*Bacon*); Pareshnath Hill and Patarghatta (*Stoliczka*); Barrackpore (*Bacon*); near Calcutta (*Stoliczka, Nevill*); Khandalla near Bombay (*W. T. B.*); Madras (*Ramanan*); Kalryenmullay Hills near Salem (*Foote*); Pedro Talle Galle, Ceylon (?); Barisal, Bengal (*Godwin-Austen*). Nevill also quotes shells from Teria Ghat, Thayet Myo, Prome, and Pegu, but these may belong to other nominal forms. Several specimens have, however, been obtained from Madagascar; and, from this locality, they cannot have been introduced by man. The occurrence of this shell in Lower Bengal has been doubted, but both Stoliczka and Nevill found it near Calcutta. Shells from Bhore Ghat (Khandalla) are intermediate between *K. barrakporensis* and *K. sigurensis*.

Animal of a pale colour, with a distinct gland at the extremity of the foot, overhung by a well-defined lobe. Mantle-lobes not observed. Parts of the genitalia are figured in the 'Land and Freshwater Mollusca of India,' showing the small pear-shaped kalc-sac [see also fig. 81, A, p. 242, *suprà*]. [The teeth of the radula are peculiar—from the small number of broad plated admedian teeth in the row, all tricuspid, the outer cusps both basal, the central point long; the laterals are narrow, much curved, and also tricuspid; the outermost minute and tricuspid,—with this formula:

26 . 7 . 1 . 7 . 26 (33 . 1 . 33).]

399. **Kaliella sigurensis**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 5, pl. 1, fig. 11 (shell).

This only differs from *K. barrakporensis* in having distinctly oblique radiating striæ on the base and not concentric microscopical impressed lines. In all probability the two pass into each other, an intermediate form having already been noted from Khandalla near Bombay.

Hab. Sigur Ghat and Neddiwatam Ghat, Nilgiri Hills.

[400. **Kaliella rissomensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 174, pl. 103, fig. 9 (shell).

Locality. Rissom Peak, Richila Peak, and Damsang Peak, Daling District.

Original description:—This shell is like *K. sivalensis* in general form, but placed alongside of it under the microscope difference is apparent in proportion of diameter to height of spire and form of columellar margin. The sculpture is also coarser.

Size: maj. diam. 3·5, alt. axis 2·6 mm.]

401. **Kaliella vulcani**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 6, pl. 1, fig. 13 (shell).

This only differs from *K. barrakporensis* in having slightly convex sides to the spire, a blunter apex, and rather more rounded whorls.

Diam. 3, height 2½ mm.

Hab. Puppa-doung near Pagan, Upper Burma (*W. T. B.*).

The only shell is not in good condition, and in better preserved specimens there might be concentric striation on the base. It is probably a variety of *K. barrakporensis*.

402. **Kaliella jaintiaca**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 7, pl. 2, fig. 4 (shell).

Shell subperforate, trochiform, thin, very minutely obliquely striated, and with very fine concentric striæ on base, pale horny brown; spire conical, sides nearly straight, apex obtuse, suture impressed; whorls 5½, convex, the last sharply keeled, convex below; aperture slightly oblique, angulately lunate; peristome thin, columellar margin vertical.

Diam. 3½, height 3 mm.

Hab. Marangsip Peak (5350′) and Sherfaisip Peak (5600′), South Jaintia Hills.

This is near *barrakporensis*, but the spire is lower and more convex at the side, and the base is more tumid and the aperture higher and more open.

[403. **Kaliella jaintiaca**, var., *Godwin-Austen, Mol. Ind.* ii, 1907, p. 174, pl. 103, fig. 10 (shell).

Locality. Hengdan Peak, N. Cachar Hills (*Godwin-Austen*).

Original description:—The typical species was found by me on Marangsip Peak, Jaintia Hills, at 5350 feet. The species now figured is from the Naga Hills and is the nearest approach I can find to it, yet it differs somewhat, particularly at the columellar margin, which is more oblique.]

404. **Kaliella cherraensis**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 4, pl. 1, fig. 5 (shell) (*nec* Nanina cherraensis, *Blf. J. A. S. B.* 1870, p. 14).

Shell narrowly perforate, high trochiform, thin, obliquely striated, with microscopic parallel impressed lines above, below decussated with radiating and concentric striæ, brownish horny; spire conoidal, rather high, sides convex, apex obtuse, suture impressed; whorls 6, flatly convex above, the last carinate, almost flat beneath; aperture oblique, subquadrately lunate; peristome thin, columellar margin oblique, reflected.

Diam. 3, height 3½ mm.

Hab. Garo, Khasi, and Naga Hills to south of Assam, and Dafla Hills to north.

The specimen measured above, from Teria Ghat, is rather large; other shells are about 2·5 to 2·7 mm. in diameter. This form is distinguished from *K. barrakporensis* by a somewhat higher spire, more convex at the sides.

405. **Kaliella manipurensis**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 5, pl. 1, figs. 9, 9 *a* (shell and sculpture), 10 (var.); pl. 2, fig. 3 (shell).

Shell subperforate, high trochiform, slightly polished, closely and obliquely ornamented under the microscope with raised striæ, on the base decussated with very minute concentric striæ and radiating lines, brownish; spire high, conoidal, sides convex, apex obtuse, suture impressed; whorls $6\frac{1}{2}$, convex, the last sharply carinate, base slightly tumid; aperture slightly oblique, almost semicircular, columellar margin well reflected, vertical above.

Diam. $2\frac{2}{3}$, height 3 mm.

Hab. Manipur Hills and Phúnggám, Lahúpa Naga Hills, 5000 ft. (*Godwin-Austen*).

The form from the Naga Hills is a little smaller, with $5\frac{1}{2}$ whorls. Some shells measure 3 mm. in diameter.

"This shell differs from the Cherra and Khasi species (*K. cherraensis*) in the whorls being more convex, more tumid below, and the columellar margin not so oblique. It is nearest in shape to *K. aspirans* of Southern India." (*Godwin-Austen.*)

406. **Kaliella khasiaca**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 5, pl. 1, fig. 8 (shell).

Shell imperforate, high trochiform, very closely obliquely ribbed above, smooth on base, brownish horny; spire conical, sides rather convex; whorls $7\frac{1}{2}$, convex, the last angulate, slightly tumid beneath; aperture subquadrately lunate; peristome thin, columellar margin vertical.

Diam. 2·25, height 2·75 mm.

Hab. North Khasi, common.

This is distinguished from *cherraensis* and *manipurensis* by not having a raised keel at the periphery, by more numerous whorls, and by want of concentric sculpture on base.

407. **Kaliella costulata**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 7, pl. 2, fig. 5 (shell).

Shell imperforate (subperforate), trochiform, thin, translucent, polished, ornamented with oblique distant ribbing, stronger than usual above, and very fine concentric striation beneath, pale horny brown; spire conical, sides straight, suture scarcely impressed; whorls $6\frac{1}{2}$, rather flat, the last carinate, flatly convex beneath; aperture slightly oblique, subquadrately lunate; peristome thin, columellar margin vertical, reflected.

Diam. $2\frac{3}{4}$, height 3 mm.

Hab. Tanir Ridge, Dafla Hills, N. of Assam, also Hengdan Peak, North Cachar Hills S. of the Assam valley (*Godwin-Austen*).

Distinguished by its well-marked costulation.

408. **Kaliella subcostulata**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 8, pl. 2, fig. 6 (shell).

This is very near *costulata*, but the ribbing is not quite so regular or so strong, the concentric striation on the base is more distant, the shell is smaller, the whorls are convex, and the suture well impressed.

Diam. $2\frac{1}{2}$, height $2\frac{1}{2}$ mm.

Hab. North Khasi Hills.

*409. **Kaliella salicensis**, *Godwin-Austen, Proc. Mal. Soc.* ii, 1897, p. 178, pl. 14, fig. 3 (shell).

"Shell perforate, conical; sculpture irregular, coarse, transverse ribbing; periostracum umber-coloured; spire conic, flat-sided, suture very shallow; whorls 7, sides rather flat; aperture quadrate, straight below; peristome suboblique, columellar margin reflected.

"Size: major diam. 2·8; alt. 3." (*Godwin-Austen.*)

Hab. Uda Pussalawa, Ceylon (*H. B. Preston*).

"The whorls of this species do not increase in breadth so much as in *K. barrakporensis*; the fine regular transverse sculpture is absent, rougher irregular ribs taking its place. The base of the Ceylon shell is not so broad, in proportion to the height of the spire, as in the Bengal species."

This is of much the same shape as *K. barrakporensis*; the last whorl is sharply keeled.

b. *Height much exceeding diameter.*

410. **Kaliella aspirans**, *W. & H. Blanf.* (Helix) *J. A. S. B.* xxx, 1861, p. 355, pl. 1, fig. 12; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 81; *H. & T.* (Helix) *C. I.* 1876, pl. 16, fig. 4; *Nevill, Hand-l.* i, 1878, p. 41; *Godwin-Austen, Mol. Ind.* i, 1882, p. 6, pl. 1, fig. 12 (shell).

Shell subperforate (subobtectly perforate), pyramidal, elevately conical, thin, scarcely striated, smooth, not polished, translucent, brownish horny; spire high, conical, sides almost straight, apex obtuse, suture shallow; whorls 7, slightly convex, the last keeled, but not sharply; aperture nearly vertical, semicircularly lunate; peristome thin, straight, columellar margin vertical, reflected, concealing the perforation.

Diam. 2, length 3 mm.

Hab. Nilgiri Hills, Pykara.

This is near *K. fastigiata*, but smaller, and higher in proportion to the diameter.

411. **Kaliella fastigiata**, *Hutton* (Helix), *J. A. S. B.* vii, 1838, p. 217; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 37; *id. t. c.* iii, 1853, p. 40; *Bens.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 272; *H. & T.* (Helix) *C. I.* 1876, pl. 16, fig. 5; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 40; *Theob. J. A. S. B.* 1881, 2, p. 40; *Godwin-Austen, Mol. Ind.* i, 1882, pp. 8, 21, pl. 2, fig. 8 (shell).

Shell imperforate (subperforate), high trochiform, thin, finely striated under the microscope, with impressed slightly oblique lines above, no concentric striation on base, pale brownish horny; spire pyramidal, sides very little convex, suture slightly impressed; whorls 7½, slightly convex, the last sharply carinate, flatly convex below; aperture nearly vertical, angulately lunate; peristome thin, margins nearly parallel, columellar vertical, triangularly reflected.

Diam. 3, height 4 mm.

Hab. Western Himalayas; Simla (*Hutton*); Landour and Mussoorie above 5000′ and beyond 7000′ (*Benson*); Hazara (*Theobald*). Nevill adds Darjiling, Dafla Hills, Naga Hills, and Arakan Hills, but the three last are open to question.

The animal is described by Hutton as greyish. It is found on dead leaves at Simla, and when in motion carries its shell upright. According to Benson, at Mussoorie and Landour it was procured creeping on the large wet leaves of *Saxifraga ciliata*, in damp and shady situations having a northern aspect.

412. **Kaliella elongata**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 9, pl. 2, fig. 9 (shell).

Shell subperforate, very elongately pyramidal, rather irregularly obliquely ribbed above, almost smooth beneath, pale horny brown; spire very high, sides convex, apex obtuse, suture impressed; whorls 9½, convex, the last carinate, flatly convex beneath; aperture slightly oblique, roundly lunate; peristome thin, outer margin sinuate, columellar vertical, rather broadly reflected.

Diam. 3, height 5⅓ mm.

Hab. Raliang, Jyntea Hills.

I have only seen one specimen of this shell, which is much more elongate than any other species of the genus.

*413. **Kaliella colletti**, *Sykes, Jour. Mal.* vii, 1899, p. 30, pl. 2, fig. 1.

"Shell subperforate, elongately pyramidal, horny, smooth, apex yellow, rather acute, the base subimpressed in the umbilical region; whorls 8, flattened, the first rapidly, the remainder slowly increasing, beneath the lens obscurely striated transversely, suture impressed; aperture quadrate, right margin thin, columellar subreflexed.

"Diam. 2·1, height 3·85 mm." (*Sykes*, in Latin.)

Hab. Binoya (3600′), Ambagamuwa, Ceylon; on bamboo, orange, and mango trees (*Collett*).

Sides of the spire strongly convex. The figure represents the mouth as nearly semicircular.

B. *Turbinate, carinate.*

[Mostly of doubtful affinity, anatomy not known.]

414. **Kaliella gratiosa**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 9, pl. 2, fig. 10.

Shell subobtectly perforate, turbinate, globosely conoid, finely, transversely, and obliquely ribbed above, minutely concentrically striated and radiately ribbed on the base, pale horny brown; spire conoid, apex blunt, suture well impressed; whorls $5\frac{1}{2}$, convex, the last with a raised keel at the periphery, tumidly convex beneath; aperture slightly oblique (?), semicircularly lunate; peristome thin, columellar margin oblique, reflected at the perforation.

Diam. $3\frac{1}{2}$, height $2\frac{3}{4}$ mm.

Hab. Kopamedza Peak, Angami Naga Hills, 8375′ (*Godwin-Austen*).

It is very doubtful whether any one of the specimens examined is adult.

415. **Kaliella animula**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 23, pl. 5, fig. 1.

Shell imperforate, turbinate, no distinct ornamentation, but indistinctly and obliquely sculptured under the microscope, and subobsoletely, very minutely, longitudinally striated above and below, pale horny brown; spire conoid, sides convex, apex obtuse, suture impressed; whorls 5, convex, the last angulately keeled, tumidly convex beneath; aperture subvertical, large, subquadrately lunate, columellar margin reflected.

Diam. $2\frac{1}{2}$, height 2 mm.

Hab. Khasi Hills (*Godwin-Austen*).

Neither of the two specimens is perfect, nor, so far as can be judged, adult.

416. **Kaliella [?] vagata**, *E. A. Smith* (Sitala), *Faun. Geog. Mald. Lac. Arch.* i, pt. ii, 1902, pp. 142, 145 [shell and radula figured by Godwin-Austen].

Shell minutely and subobtectly perforated, obtusely turbinate, thin, fuscous brown, decussated by oblique fine striæ of growth and by minute spiral lines, above and below; spire moderately raised, apex obtuse, suture impressed; whorls 5, convex, regularly increasing, the last sharply angulate at the periphery, convex beneath; aperture oblique, lunate; peristome thin, columellar margin vertical, rather broadly reflexed, partly covering the umbilicus.

Major diam. 3, min. $2\frac{3}{4}$, height $2\frac{1}{2}$ mm.

Hab. Minicoi Island, between the Laccadives and Maldives.

Probably introduced, like other shells of those islands, from the Malabar coast.

The teeth of the radula number:

32 . 6 . 1 . 6 . 32 (38 . 1 . 38).

The admedian teeth, like the rhachidian, have a long median cusp and lateral cusps as in *K. barrakporensis*, &c. [The internal anatomy has not been seen, it therefore can only be placed in this genus with doubt.]

*417. **Kaliella [?] kjellerupi**, *Mörch* (Nanina), *Jour. Conchyl.* xx, 1872, p. 310; *Pfr.* (Helix) *Mon. Hel.* viii, 1877, p. 72; *Godwin-Austen* (Sitala), *P. Z. S.* 1895, p. 442.

"Shell imperforate, turbinate, keeled, yellowish, smooth; spire conoid, apex obtuse, flattened, base convex, very smooth, suture very narrowly marginate; whorls 5, slightly convex, increasing slowly, nearly equal in size, the last not descending; striæ of growth not prominent, irregular; aperture rhomboidally lunate, columellar margin thickened, subreflected.

"Diam. maj. 6, axis nearly 4 mm." (*Mörch*, in Latin.)

Hab. Great Nicobar.

418. **Kaliella teriaensis**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 10, pl. 2, fig. 12 (shell).

Shell subperforate, depressedly subtrochiform, almost smooth, with extremely fine oblique ribbing on upper whorls only seen under microscope, the base smooth, bleached, probably when fresh brownish; spire conical, sides straight, suture impressed; whorls 5, convex, the last sharply keeled, convex below; aperture nearly vertical, securiform, subquadrately lunate; peristome thin, columellar margin oblique.

Diam. 3·7, height 2 mm.

Hab. Teria Ghat, at southern base of Khasi Hills (*Godwin-Austen*).

419. **Kaliella nagaensis**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 9, pl. 2, fig. 11 (shell).

Shell imperforate, trochiform, marked above with fine oblique ribbing only visible under the microscope, and with radiating lines on base, pale horny brown; spire conical, sides straight, suture impressed; whorls 6, convex, the last carinate, with a slightly raised keel, rather flat below; aperture slightly oblique, angulately lunate; peristome thin, the columellar margin thickened and reflected, rounded below, briefly vertical above.

Diam. 3½, height 2½ mm.

Hab. Kopamedza Peak (8375′) and Naga Hills. [Dikrang Valley, Dafla Hills, and Barowli Gorge north of Tezpur (*Godwin-Austen*).]

The spire is considerably higher than in *K. teriaensis*, and lower than in *K. barrakporensis* and its allies.

[420. **Kaliella paucistriata**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 174, pl. 103, fig. 10 (shell).

Locality. Dikrang Valley, Dafla Hills (*Godwin-Austen*).

Original description :—Shell keeled, depressedly pyramidal; sculpture microspiral striation with coarse, irregular, distant, transverse costulation, the same shown on the basal side; colour very pale ochre; spire moderately high, sides flat; suture shallow. Whorls 5, sides flatly convex; aperture not complete, probably quadrate; peristome thin; columella broken.

Size: maj. diam. 3·8, alt. axis 2 mm.

The form of this shell is very like that of *K. nagaensis*, but has different sculpture.]

[421. **Kaliella richilaensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 175, pl. 103, figs. 2, 2 *b*.

Locality. Richila Peak, Bhutan frontier, 10,370 feet (*W. Robert*).

Original description :—Shell globosely conoid, very rounded below, very narrowly umbilicated; sculpture, transverse distant costulation, rather fine, not regular; colour pale sienna-brown; spire moderately high, sides flat, apex blunt, suture impressed; whorls 5, keeled on the last, but with no carination, flatly convex; aperture narrowly lunate; peristome thin, columellar margin nearly perpendicular, reflected near the umbilicus.

Size: maj. diam. 3·3, alt. axis 1·8 mm.

Somewhat of the form of *K. nagaensis*; it is, however, a smaller shell and the sculpture is not so fine and regular as in that species.]

[422. **Kaliella richilaensis**, var., *Godwin-Austen, Mol. Ind.* ii, 1907, p. 175, pl. 103, fig. 2 *a*.

Locality. Richila Peak, Bhutan frontier, 10,370 feet (*W. Robert*).

Original description :—Shell globosely conoid, not umbilicated, covered with a strong epidermis; sculpture very regular fine costulation; colour strong sienna tint; spire moderately high, conoid, apex rounded, suture shallow; whorls 5, rather flatly convex; aperture narrowly lunate; peristome thin, columellar margin subvertical, but very slightly reflected.

Size: maj. diam. 3·6, alt. axis 2·2 mm.]

C. *Turbinate or globosely conoid, not carinate.*

423. **Kaliella? nana**, *Hutton* (Helix), *J. A. S. B.* vii, 1838, p. 218; *Pfr.* (Helix) *Mon. Hel.* i. 1848, p. 31; *H. & T.* (Helix) *C. I.* 1876, pl. 61, figs. 7, 8, 9; *Nevill*, Nanina (Microcystis), *Hand-l.*

i, 1878, p. 38; *Godwin-Austen, Mol. Ind.* i, 1882, p. 21, pl. 5, fig. 6 (shell); ii, 1898, p. 47.

Helix bullula, *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 72, *nec Hutton.*

Shell obtectly perforate, globosely conoid, smooth, under the microscope finely obliquely ribbed above, and with radiating lines on base, pale horny brown; spire conoid, sides convex, apex obtuse, suture well impressed; whorls $5\frac{1}{2}$, convex, closely wound, the last rounded at periphery and below; aperture nearly vertical, lunate; peristome simple, columellar margin oblique, reflected, concealing perforation.

Diam. 2·3, height 2 mm.

Hab. N.W. Himalayas; Simla, Kulu, Mussoorie; Darjiling. Nevill adds Moisraka, Midnapur district, Calcutta (Botanical Gardens), and Pt. Canning: [very doubtful if it is the same species].

Hutton notes that this form is common at Simla and that the colour of the animal is dark grey. Of the animal found in Calcutta, Stoliczka notes (quoted by Nevill) that it has a small gland with a short horn above and no mantle-lobes.

The process on the columellar lip of the peristome which covers the perforation resembles that of *Microcystina*. It is best seen in very old shells.

424. **Kaliella ? bullula**, *Hutton* (Helix), *J. A. S. B.* vii, 1838, p. 218; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 86; *H. & T.* (Helix) *C. I.* 1876, pl. 61, figs. 2, 3; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 37; *Godwin-Austen, Mol. Ind.* i, 1882, p. 23, pl. 5, figs. 4, 5 (shell).

Shell subperforate, turbinate, globosely conoid, smooth, under the microscope seen to be ornamented by fine oblique ribbing above and indistinct subobsolete concentric striæ on base, pale horny; spire conoid, apex obtuse, suture impressed; whorls 5, convex, the last subangulate at periphery, descending slightly in front, convex beneath; aperture subvertical, broadly lunate; columellar margin oblique, slightly reflected.

Diam. 4, height 3 mm.

Hab. Western Himalayas; Simla, Kulu, Chor, Landour, Mussoorie, Kumaun.

The type was obtained amongst dead leaves at Simla. The shell described by Pfeiffer as this species (Mon. Hel. iv, p. 86) was not *bullula* but *nana*.

425. **Kaliella ? resinula**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 22, pl. 5, figs. 7, 8 (shell).

Shell obtectly perforate, globosely conoid, very finely and closely transversely costulately striated, the sculpture microscopical and often obsolete, pale brownish horny; spire conoid, rather high,

sides strongly convex, apex obtuse, suture deep; whorls $6\frac{1}{2}$, convex, the last larger, rounded at periphery, convex beneath; aperture semicircularly lunate, nearly vertical; peristome thin, columellar margin rather broadly reflected, covering perforation.

Diam. 2·25, height 2·1 mm.

Hab. Khasi Hills.

This is very near *K. nana*, but higher and with an additional whorl.

*426. **Kaliella? sikkimensis**, *Godwin-Austen* (*Nevill, MS.*), *Mol. Ind.* i, 1888, p. 22, pl. 5, fig. 9 (shell); *id. t. c.* ii, 1907, p. 175, pl. 103, fig. 4 (shell).

This is another close ally of *K. nana* and *K. resinula*, and has nearly the same dimensions as the latter; it is even more globose, the sides of the spire more convex, and with the last whorl proportionately larger. I have not seen a specimen.

Hab. Sikhim.

[*Locality.* Shell figured (pl. 103) is from the Risett chu Valley, South Sikhim (*W. Robert*).

Original description:—Shell globosely conoid, scarcely perforate; sculpture very fine, close, regular, transverse striation; colour pale sienna-brown; spire conical, less than the major diameter, apex blunt, sides convex, suture moderately impressed; whorls 6, rather convex, closely wound; aperture narrowly lunate, vertical; peristome thin, columellar margin oblique and but slightly reflected.

Size: maj. diam. 1·9, alt. axis 1·6 mm.

This pretty little shell, of which the type described by me is in the Indian Museum, Calcutta, appears to be fairly numerous in the deep hot valleys of Sikhim.]

427. **Kaliella? lhotaensis**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 22, pl. 5, fig. 2 (shell).

Shell imperforate, convexly conoid, depressedly subturbinate, with fine subcostulate transverse striation under the microscope, often obsolete, radiately striate beneath, pale brown; spire conoid, sides convex, apex obtuse, suture impressed; whorls $5\frac{1}{2}$, convex, the last subangulate at periphery, rounded below; aperture oblique, roundly lunate; peristome thin, columellar margin vertical, reflected.

Diam. 2·2, height 1·7 mm.

Hab. Lhota Naga Hills.

This is also allied to *K. nana*, but has a much lower spire.

[428. **Kaliella? shillongensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 176, pl. 103, fig. 5 (shell).

Locality. Shillong, Khasi Hills (*Godwin-Austen*). Two specimens were found.

Original description:—Shell globosely conoid, very narrowly umbilicated, rounded below; sculpture very fine, regular transverse ribbing; colour umber-brown; spire less than breadth, apex blunt; suture well impressed; whorls $5\frac{1}{2}$, rather closely wound, sides convex; aperture lunate, suboblique; peristome thin, scarcely reflected, columellar margin suboblique.

Size: maj. diam. 2·1, alt. axis 1·4 mm.

Compared with *K. lhotaensis*, this shell is smaller and the whorls much more convex; with typical *flatura*, it is larger, but the whorls do not increase in the same way and in the same proportion; and the same may be said of the very similar shell from the Sikhim frontier, which differs in having a larger body-whorl and larger aperture; they all, in fact, merge into one another.]

429. **Kaliella? flatura**, *Godwin-Austen, Mol. Ind.* i, 1882, p. 23, pl. 5, fig. 10 (shell).

Shell perforate, convexly conoid, subturbinate, very finely costulately striated under the microscope, the sculpture generally obsolete, below marked with curved radiating striæ, horny brown; spire conoid, sides convex, apex obtuse, suture impressed; whorls 5, convex, last broader, rounded at periphery and below; aperture semicircularly ovate, subvertical; peristome thin, columellar margin vertical and reflected.

Diam. 2, height 1·5 mm.

Hab. Manipur.

This has a deeper suture and a broader last whorl than the species of the *K. nana* section generally.

[430. **Kaliella? flatura**, var., *Godwin-Austen, Mol. Ind.* ii, 1907, p. 176, pl. 103, fig. 3 (shell).
Kaliella flatura, *Godwin-Austen, Mol. Ind.* i, 1882, p. 23, pl. 5, fig. 10.

Locality. Richila Peak, 10,370 feet, on Darjiling-Bhutan frontier (*W. Robert*), also Risett chu Valley and Damsang.

Original description:—Shell globosely conoid, umbilicated; sculpture very minute, transverse ribbing, only visible under high power, smooth to eye and not so regular on the last whorl as it is on the rest of the whorls; colour pale ochre; spire, sides slightly convex, apex rounded, suture well impressed; whorls 5, very convex; aperture semilunate; peristome thin, columellar margin suboblique and slightly reflected.

Size: maj. diam. 2·25, alt. axis 1·30 mm.

It is interesting to find this minute shell in the Eastern Himalaya, so extremely close in form to that I found in Munipur, the sculpture on the last whorl not being so regular as in the type; it is similar above.]

D. *Lenticular, sharply keeled, decussated.*

431. **Kaliella? burrailensis,** *Godwin-Austen, Mol. Ind.* i, 1883, p. 70, pl. 15, figs. 5, 5*a*, 5*b* (shell).

Shell minutely perforate, lenticular, thin, transversely obliquely ribbed and decussated by rather irregular striation above, below radiately and more strongly but very irregularly concentrically ribbed, pale horny; spire low, conoidal, sides convex, suture very shallow, apex slightly prominent; whorls $5\frac{1}{2}$, flat above, the last keeled, convex beneath, not so prominent as the spire; aperture subvertical, angulately lunate, narrow; peristome thin, columellar margin oblique.

Diam. 5, whole height 2·6 mm.

Hab. Burrail Range, Naga Hills.

Distinguished by minute perforation from the umbilicate *K. kezamahensis* and *lailangkotensis*, also by sculpture and other characters.

432. **Kaliella? ruga,** *Godwin-Austen, Mol. Ind.* i, 1883, p. 70, pl. 15, fig. 4 (shell).

Shell perforate, sublenticular, transversely ribbed and decussated by impressed lines above and below, pale horny; spire low, conoid, suture impressed; whorls 5, convex, the last sharply angulate, tumid below, more swollen than the spire is above the keel; a small pitted mark behind the lower margin of peristome, showing inside the aperture as a minute plait, not always conspicuous, as in *Sesara helicifera*; aperture subvertical, angularly lunate; peristome thin, columellar margin very oblique.

Diam. 3, height 2 mm.

Hab. Phúnggám, Lahúpa Naga Hills, and Shiroifurar Peak, N.E. Munipur, 9000 ft.

E. *Shell conoidal, carinate, with a long narrow aperture.*

[433. **Kaliella? dikrangensis,** *Godwin-Austen, Mol. Ind.* i, 1883, p. 72, pl. 16, fig. 3 (shell).

Original description:—Shell globosely conoid, keeled, imperforate, much rounded below; sculpture very microscopic, transverse regular costulation, the finest I have seen; colour pale amber; spire pyramidal, sides nearly flat, apex well rounded, suture moderately impressed; whorls 6, closely wound; aperture narrowly quadrate; columellar margin strong, perpendicular, with a slight protuberance on the inner margin.

Major diam. 1·6, height 1·1 mm.

Hab. Dikrang Valley, Dafla Hills (*Godwin-Austen*).

This shell, of which I only possess one example, is similar in form and comes nearest to *K.*? *nongsteinensis* (Jainta Hills), but

is very much smaller, the spire less conoid, and much more rounded below. The sculpture is similar to that of *Kaliella*.

Nothing is known of the anatomy of these very minute species.]

434. **Kaliella? nongsteinensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 72, pl. 16, fig. 2 (shell).

Shell imperforate, conoid, subtrochiform, under a powerful microscope costulately striate, pale brownish; spire conoidal, rather high, sides convex, apex obtuse, suture shallow; whorls 8, closely wound, slightly convex, the last carinate, projecting in the middle around the umbilical region, rather flat outside near the keel; aperture narrow, rectangular, oblique to the axis of the shell; peristome ——?

Diam. 2, height 1·7 mm.

Hab. Maotherichan Peak, N. Khasi.

[435. **Kaliella bhutanensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 196, pl. 103, fig. 7 (shell).

Locality. Damsang, Daling District, Western Bhutan Hills.

Original description:—Shell conical, perforate, flatly rounded on base, keeled; sculpture microscopic, transverse, irregular lines of growth, these are well shown on the basal side; colour pale dull ochreous; spire high, with convex sides, apex blunt; suture very shallow; whorls 8, closely wound, flat-sided; aperture narrowly quadrate; peristome thin, columellar margin short, nearly vertical.

Size: maj. diam. 2·23, alt. axis 1·6 mm.

Its nearest ally is *K. nongsteinensis*, of the North-western Khasi Hills; but it is broader on the keel in proportion to height of spire and much flatter on the base.]

436. **Kaliella? tirutana**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 72, pl. 16, figs. 4, 5 (shell).

Shell imperforate, conoidal, with the area below the carination prominent, smooth, whitish horny (? bleached); spire conoidal, sides slightly convex, apex obtuse, suture shallow; whorls 6, convex, closely wound, narrow, the last keeled, flattened, but inclined below keel, and projecting considerably in the umbilical region; aperture narrow across, but long, almost rectangular, and elongate in a line oblique to the axis; peristome with columellar margin straight, oblique, and reflected.

Diam. $1\frac{1}{2}$, height $1\frac{1}{4}$ mm.

This resembles *nongsteinensis*, but is smaller, and has fewer whorls and a less convex spire. It has the same rectangular mouth inclined to the axis of the shell.

437. **Kaliella? chennelli**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 73, pl. 16, fig. 1 (shell).

Shell imperforate, depressedly conoid, lenticular, finely transversely striated above, below radiately striated with traces of concentric lines, pale horny brown; spire conoid, sides flat, suture shallow; whorls $6\frac{1}{2}$, closely wound, almost flat above, the last carinate, convex below, lower surface not so prominent as the spire; aperture vertical, narrow, subquadrangular; peristome thin, columellar margin slightly oblique, reflected.

Diam. $3\frac{1}{2}$, height 2 mm.

Hab. Lhota Naga Hills.

This is distinguished by its numerous whorls and narrow elongate aperture. It is said to be finely hairy when fresh.

F. *All the whorls carinate in middle, last whorl bicarinate.*

438. **Kaliella? conulus**, *W. T. Blanford* (Nanina), *J. A. S. B.* 1865, 2, p. 73; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 89; *H. & T.* (Helix) *C. I.* 1876, p. 129, figs. 5, 6; *Nevill*, Nanina (Microcystis), *Hand-l.* i, 1878, p. 41; *Godwin-Austen, Mol. Ind.* i, 1883, p. 71, pl. 15, figs. 6, 6 *a* (shell).

Shell imperforate (subperforate), turreted, thin, translucent, marked with oblique, sinuous, subfiliform, costulate striation, and on the base with radiating striæ and very fine spiral lines, white horny; spire conical, apex rather obtuse, suture deep; whorls 6, very convex, keeled in the middle, the keel very fine, raised, thread-like, and white; the last whorl bicarinate, the second spiral keel being below the periphery, flatly convex beneath; aperture oblique, rhomboidally lunate, about equally broad and high; peristome thin, columellar margin nearly vertical, very briefly reflexed at the penultimate whorl.

Diam. $1\frac{3}{4}$, height 2 mm.

Hab. Phoung-do, near Taungup, Arakan (*W. T. Blanford*); Jatinga Valley, North Cachar Hills, and Manipur (*Godwin-Austen*).

This form stands alone, no near ally having been found. It may have relations to the Andaman *Sitala? homfrayi* and *S. subbilirata*, now referred to *Philalanka*.

439. **Kaliella? peliosanthi**, *Mörch*, Helix (Kaliella), *Vidensk. Medd.* xi, 1872, p. 13; *Godwin-Austen, Mol. Ind.* i, 1883, p. 92.

"Shell very minute, trochiform, obtectly perforate; whorls $4\frac{1}{2}$, angulate in the middle, spirally lineate; lines of growth prominent, at regular distances; the last whorl bicarinate, flat and smooth at the base, the umbilicus narrow and oblique; epidermis very thin, hairy on the keels; aperture rhombic, columellar margin subdentate.

"Diam. $1\frac{1}{10}$, height $1\frac{1}{5}$ mm." (*Mörch*, in Latin.)

Hab. Calcutta.

Found on leaves of *Peliosanthes teta* from the Harbour of Calcutta. Said to be somewhat similar to *K. conulus*, but much smaller.

II. *Umbilicated.*

*440. **Kaliella? feæ**, *Tap. Canefri, Ann. Mus. Civ. Gen.* xxvii, 1889, p. 321, pl. 8, figs. 7, 8.

"Shell deeply umbilicated, conical, trochiform, pale horny; spire conical, apex obtuse; whorls about 7, subconvex, ornamented with minute oblique regular striæ, divided by impressed sutures, the last not descending in front, obtusely carinate at periphery, convex beneath; aperture roundly lunate, obscurely subquadrate; peristome simple, slightly expanded below, margins remote, columellar reflected below umbilicus.

"Major diam. 9, min. 8½, height 8 mm." (*Tap. Can.*, in Latin.)

Hab. Mount Mouleyit, Burma, East of Molmein (*Fea*).

*441. **Kaliella delectabilis**, *Sykes, Proc. Mal. Soc.* iii, 1898, p. 70, pl. 5, fig. 7; *Godwin-Austen, Mol. Ind.* ii, 1883, pl. 93, fig. 4 (sculpture only).

"Shell ovately conoid, narrowly but perspectively umbilicated, horny, smooth; whorls 6, convex, under the lens microscopically striated transversely (longitudinally), the last carinate at the periphery, inflated beneath; apex smooth, suture impressed; aperture semilunate, columellar margin of peristome reflected.

"Diam. 2·8, height 3 mm."

Hab. Ambagamuwa, Ceylon (*Collett*).

*442. **Kaliella? leithiana**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 71, pl. 16, figs. 6, 6 *a*, 6 *b*; *Sykes, Proc. Mal. Soc.* iii, 1898, p. 71.
? Plectopylis eugenii, *Jones, Mém. Soc. Zool. France*, vii, 1894, p. 277.

"Shell narrowly umbilicated, discoid, keeled, base flat; sculpture covered with an olivaceous epidermis, irregular transverse lines of growth; spire very depressedly conoid, sides flat, apex blunt; whorls 6½, all very equal in breadth, flat; aperture elongate, narrow, perpendicular; peristome thin, columellar margin upright, short.

"Major diam. 7, alt. axis 2·4 mm." (*Godwin-Austen.*) (Height 2·7 mm. from figure.)

Hab. Ceylon.

The shell is represented in the figure as lenticular with a prominent keel, and may at once be recognized by its very narrow angulate mouth. As the specimen was purchased from the late Dr. Leith's collection and the locality depended on his having marked the same on a card, the habitat may not be quite certain,

for it is not probable that Dr. Leith himself collected in Ceylon, and the shell does not resemble other Ceylonese or S. Indian forms.

443. **Kaliella? kezamahensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 69, pl. 15, figs. 3, 3 *a* (shell), p. 146, pl. 40, fig. 10 (radula and spermatophore).

Shell narrowly umbilicate, depressedly trochiform, decussated above by oblique and spiral ribbing, below by radiating and concentric, the transverse (oblique or radiating) close, the spiral more distant, pale horny; spire conoid, apex obtuse, suture slightly impressed; whorls 5, flatly convex above, the last sharply keeled, almost flat beneath; aperture slightly oblique, subtrapezoidal, angulately lunate; peristome thin, curved back on right margin, columellar margin very oblique, scarcely reflected.

Diam. 4·25, height 2·5 mm.

Hab. Kezamah, Anghami Naga Hills; Gaziphima, Naga Hills (*Godwin-Austen*).

The lingual ribbon which has been extracted from a dried individual closely resembles that of *K. lailangkotensis*. The formula is 25 . 6 . 1 . 6 . 25 (31 . 1 . 31); rhachidian and admedians tricuspid; laterals bicuspid, with the outer cusp far back, not near the terminal one. The laterals differ from those of *K. barrakporensis*.

444. **Kaliella? lailangkotensis**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 68, pl. 15, fig. 1 (shell), pl. 20, figs. 2, 2 *a* (jaw and radula).

Shell narrowly and deeply umbilicated, sublenticular, decussated with transverse and longitudinal ribbing above and below, the concentric (longitudinal) sculpture disappearing near the umbilicus, pale brownish; spire low, conoidal, sides convex, suture impressed; whorls 5, convex, the last angulate at periphery, convex below; aperture slightly oblique, angulately lunate; peristome thin, columellar margin oblique.

Diam. 4·3, height 2·3 mm.

Hab. Lailangkote, Khasi Hills, common, also at Mairang, Teria Ghat, Maotherichan Peak, and Mokarsa.

The lingual ribbon is very similar to that of *K. kezamahensis*, and the formula is 26 . 2 . 5 . 1 . 5 . 2 . 26 (33 . 1 . 33). The lower surface is much more tumid than in that species, mouth broader, &c.

III. *Subturbinate, whorls rapidly increasing.*

445. **Kaliella? nevilli**, *Godwin-Austen, Mol. Ind.* i, 1883, p. 70, pl. 13, fig. 6.

Shell umbilicated, depressedly conoid, subturbinate, thin, rugately subcostulate transversely, radiately striated below, periphery furnished with hairs, pale brownish horny; spire conoid, apex

prominent, suture impressed; whorls $4\frac{3}{4}$, convex, the last slightly angulate at periphery, rather tumid below; aperture oblique, roundly lunate; peristome thin, columellar margin vertical, slightly reflected above.

Major diam. 7, min. 6, height $3\frac{1}{2}$ mm.

Hab. Darjiling.

The relations of this shell are very doubtful. It cannot be a *Kaliella* to judge by the shell.

[Genus **SARAMA** *.

Type, *S. kala*.

Range. Hill-ranges south of Sikhim.

The animal of the type species, and the only one of the genus as yet known, is remarkable for its very dark coloration. The shell-lobes are as in *Macrochlamys*, the right narrow and tongue-like. The type differs from *Macrochlamys* in the three following important characters:—

1. The absence of the amatorial organ; 2. The absence of the coiled cæcum near the retractor muscle of the penis; 3. Form of the spermatophore, which is short and with spines on the side of the capsule. To these may be added the form of the jaw, which is very straight on the cutting-edge.]

446. **Sarama kala**, *Godwin-Austen* (Macrochlamys), *Mol. Ind.* i, 1883, p. 108, pl. 40, figs. 1–9 (shell and anatomy); ii, p. 135 (spermatophore).

[*Vide* fig. 83, p. 276.]

Shell minutely perforate, conoidly depressed, thin, translucent, polished, with very fine, close, longitudinal (spiral) striation throughout under the microscope, pale greyish horny; spire low, conoidal †, the sides straight, suture slightly impressed; whorls 5, slightly convex, the last rounded at the periphery and below; aperture nearly vertical, lunate; peristome very thin, columellar margin subvertical above, rather broadly triangularly reflected.

Major diam. 8·5, min. 7, height 4 mm.

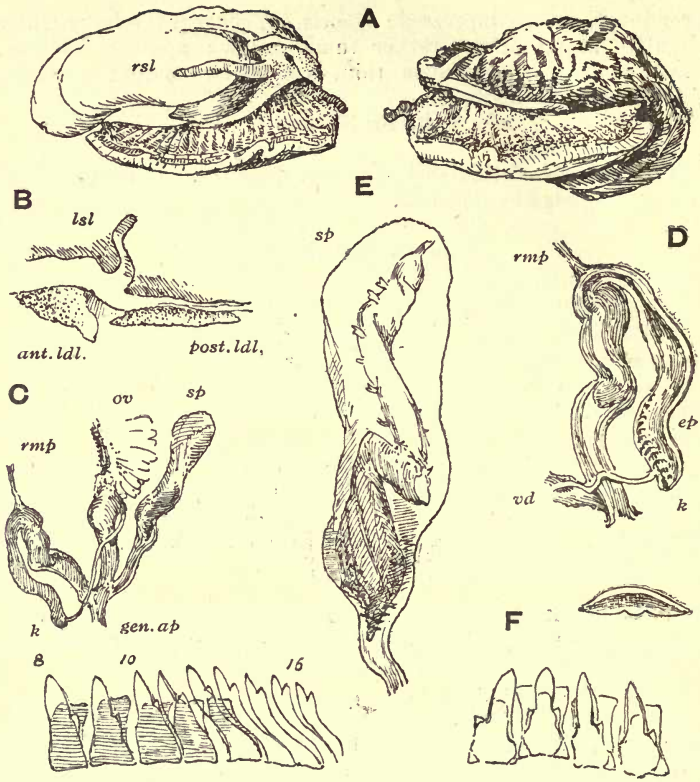
Hab. Damsang Peak, Daling Hills, Western Bhutan (*W. Robert*).

Animal very dark-coloured above; pedal margin and sole pale. No dart-sac and no cæcum to the penis, the retractor muscle being attached directly to head of penis and epiphallus. Teeth on radula 40.2.8.1.8.2.40(50.1.50): median tooth tricuspid; inner laterals with a single basal cusp on the outer side, outer laterals bicuspid. [The jaw is abnormal, being very straight on the cutting-edge.]

Not one of the specimens examined appears completely adult. This species may be found in Sikhim and the mountains of Bhutan.

* [Sanskrit "the dawn"; "Hermes" in Greek.]

† [The spire is higher than it is represented in plate 40 of the 'Mollusca of India.' [This, the type, was outlined with the aid of camera lucida. The height of spire is a very variable character in many of these species.]



[Fig. 83.—*Sarama kala.*

A. Animal, spirit-specimen, views of right and left sides, shell removed. × 4.
B. Edge of mantle, left shell-lobe, and left dorsal lobes. × 7.
C. Generative organs. × 4.
D. The penis, with a spermatophore forming in the epiphallus. × 7.
E. The spermatheca, containing a perfect spermatophore. × 12.
F. Jaw and teeth of the radula. × 340.]

[Genus **SARIKA.**

Orobia resplendens, *Albers, Die Heliceen*, 1860, p. 58.
Nanina (Macrochlamys), *G. Nevill, Hand-l.* i, 1878, p. 20.
Sarika, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 179.

Type, *S. resplendens*, Phil.

Range. Tenasserim to Siam.

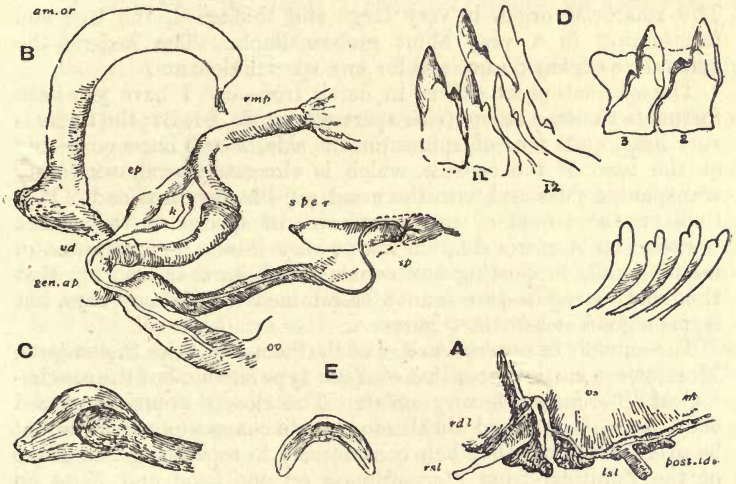
Original description:—Shell depressed, flat on base, smooth, shining; whorls very closely wound and regularly increasing.

Animal with right and left mantle-lobes as in *Macrochlamys*. Generative organs differ, the retractor muscle of the penis is very large and given off directly at the head of that organ; no coiled cæcum; amatorial organ long, with a rounded terminal knob. Spermatophore spineless.]

447. **Sarika resplendens**, *Phil.* (Helix) *Zeitschr. f. Malak.* 1846, p. 192; *Pfr.* (Helix) *in. Mart. & Chemn. Conch.-Cab.* ed. 2, no. 688, pl. 110, figs. 7–9; *id.* (Helix) *Mon. Hel.* i, 1848, p. 56; *H. & T.* (Helix) *C. I.* 1876, pl. 51, fig. 4; *Nevill*, Nanina (Macrochlamys), *Hand-l.* i, 1878, p. 20, pt.; *Godwin-Austen*, *Mol. Ind.* i, 1883, pp. 109, 110, pl. 26, figs. 1–3 (shells); *id. t. c.* ii, 1898, p. 49; [ii, 1907, p. 179, pl. 111, figs. 3, 3 *a* (genitalia), pl. 116, figs. 2–2 *b* (shell and dorsal lobes and radula)]; *v. Mart. Jour. Linn. Soc.* xxi, 1889, p. 162.

Helix subcornea, *apud Hanley, C. I.* 1876, pl. 149, figs. 2, 3: *nec Pfr.*

Shell perforate, depressed, smooth, polished throughout, thin, pale, yellowish tawny, without longitudinal sculpture; spire very low, suture well impressed; whorls 7, convex, regularly increasing, the last rounded at the periphery and convex, slightly flattened beneath, deeply impressed in the middle; aperture nearly vertical,



[Fig. 84.—*Sarika resplendens.*

A. Mantle-edge detached from the animal, shell- and dorsal lobes.
B. The genitalia.
C. Anterior end of the amatorial organ.
D. Teeth of the radula.
E. Jaw.]

broadly lunate; peristome thin, almost straight, basal margin faintly arcuate, columellar oblique, briefly reflected above.

Major diam. 25½, min. 23½, height 12 mm.

Hab. Mergui, Tenasserim; Mergui Archipelago; also Siam and Cambodia.

In the animal both shell-lobes are well developed, as in *Macrochlamys indica*. Neck-lobes small. There is a long flagellum-like

kalc-sac, a long spermatheca, and a large dart-sac or amatorial organ. The formula for the radula is: 42 . 2 . 10 . 1 . 10 . 2 . 42 (54 . 1 . 54). [The jaw has no central projection.]

[External characters, such as the shell-lobes present, led me in 1898 (Mol. Ind.) to place this species in *Macrochlamys*, but it differs in many respects from the typical Indian species of that genus. Further material received since has shown the internal anatomy to be very different.

The penis-sheath enlarges upwards from the generative aperture to the broad, rather flat, and long retractor muscle. The epiphallus is long, and where it is joined by the vas deferens a kalk-sac nearly as long is given off. Within the length of the epiphallus in this specimen a spermatophore was in an advanced stage of development, the sac of which is indicated by the swelling close to the vas deferens. The spermatheca is very long, a narrow tube swelling into an elongate, pear-shaped, thin-walled sac. This contained a single perfectly formed spermatophore. The amatorial organ is very large and thickened, the free end terminating in a very blunt globose knob. The rest of the generative organs do not call for any special mention.

The spermatophore differs in detail from any I have yet been fortunate to come across (*vide* spermatheca, fig. 84, B); the flume is very long, quite free of spines on the side, 2 or 3 large ones only at the base of the capsule, which is elongately oval, with very transparent sides and with the usual cap-like terminal end. It is thus on the mould of spermatophores of species of the genera *Girasia* and *Austenia* &c., but shows very interesting variation in minor detail, supporting the conclusion I have arrived at, that this species *resplendens* cannot be retained in *Macrochlamys*, but forms a good and distinct genus.

The animals of *resplendens* and of the Siamese species *S. pumicata*, Morelet, are much nearer that of *Xesta* type *citrina*, but the conchological differences are very great. The closely-wound depressed shell of *resplendens* and its allies presents characters which cannot be overlooked, and they help considerably in separating this group of the Zonitidæ from *Macrochlamys* on one hand and *Xesta* on the other.]

Hanley's figure (C. I. pl. 51, fig. 4) agrees fairly with Pfeiffer's and would appear to be some other species. Reeve's figure (Conch. Ic. no. 430) is something different. Many different shells are found in various collections under this name. The description above is from a Mergui specimen in Col. Godwin-Austen's Collection.

448. **Sarika burmana**, *Pfr.* (Helix) *P. Z. S.* 1857, p. 107; *id. Mon. Hel.* iv, 1859, p. 42; *H. & T.* (Helix) *C. I.* 1876, p. vii.
Helix acerra, *Bs. A. M. N. H.* (3) iii, 1859, p. 389; *Pfr. Mon. Hel.* v, 1868, p. 100; *H. & T. C. I.* 1876, pl. 51, fig. 2; *v. Mart.* (Macrochlamys) *Jour. Linn. Soc.* xxi, 1889, p. 162; *Kobelt* (Macrochlamys), *Mart. & Chemn. Syst. Conch.-Cab.* ed. 2, 1901, Naninidæ, p. 1020, pl. 263, fig. 1.

Shell perforate, depressed, rather solid, without sculpture, white, with a brownish-yellow band above the periphery and inside the suture; spire low, conoid, suture scarcely impressed; whorls 7, slightly convex, slowly increasing, the last rounded at the periphery and convex beneath; aperture oblique, broadly lunate; peristome blunt, slightly thickened, columellar margin oblique and slightly curved throughout, reflected above.

Major diam. 25, min. 23, height 12 mm.

Hab. Mergui, Burma; Mergui Archipelago (*Anderson*).

Hanley has united *burmana* and *acerra*. The spiral band of the former has not been observed in the latter, which is slightly larger and more depressed: $28 \times 25 \times 11$ mm.

Genus **TAPHROSPIRA.**

Taphrospira, *W. T. Blf. P. Z. S.* 1905, p. 441; [*Godwin-Austen, Mol. Ind.* ii, p. 177, pl. 111, figs. 1–1*f* (animal and anatomy)].

Type, *T. convallata*, Bs.

Range. Assam Hills, Burma, Tenasserim, and the Andaman Islands.

Shell depressed, thin, horny, resembling *Macrochlamys*, but with a deep groove just outside the suture throughout the whorls.

Anatomy not known.

[For a long time the position shells of this form should fill has been one of considerable doubt; it was placed provisionally in *Macrochlamys*. *Taphrospira* proves to be a very distinct genus, not only by shell-character, on which Dr. W. T. Blanford founded it, but also still more conclusively on the character of the animal. It is like *Macrochlamys* only as regards the right shell-lobe; the ample left shell-lobe resembles that of species of *Austenia*. The absence of the amatorial organ is the strongest point which differentiates it both from *Macrochlamys* and *Austenia*. The penis is more like *Austenia* than typical *Macrochlamys*, so also is the spermatophore.]

449. **Taphrospira convallata**, *Bs.* (Helix) *A. M. N. H.* (2) xviii, 1856, p. 250; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 46; *H. & T.* (Helix) *C. I.* 1876, pl. 88, figs. 2, 3; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 28; *v. Mart. Jour. Linn. Soc.* xxi, 1889, p. 162.

Shell minutely perforate, subglobosely depressed, thin, smooth, greyish horny; spire depressedly conoid, suture deeply but not broadly canaliculate; whorls 6–7, closely wound, all except the innermost sharply angulate above near the suture, the last rounded, not descending, convex below; aperture scarcely oblique, lunate, angulate above and with an indentation corresponding to the sutural canal; peristome thin, slightly arcuate externally and basally, columellar margin oblique, slightly expanded throughout, more broadly above.

Major diam. $14\frac{1}{2}$, min. 13, height 8 mm.

Hab. Tenasserim Valley, Therapon Hill (*Theobald*); Mergui Archipelago (*Anderson*). Nevill adds Pegu, but evidently in error.

Animal not known. No fresh specimen is available, and it is uncertain whether microscopic striation occurs. A large shell measures 16, 14½, and 8½ mm.

450. **Taphrospira compluvialis,** *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 66; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 103; *Blf. P. Z. S.* 1904, ii, p. 442, pl. 25, fig. 4.

Shell perforate, subglobosely depressed, thin, pale horny, translucent, with very fine, close, microscopic, longitudinal striation above and below; spire very low, suture deeply and broadly canaliculate; whorls 4½, sharply angulate above at edge of sutural groove, the last descending somewhat towards the mouth, rounded at the periphery and convex beneath; aperture oblique, roundly lunate, about as high as broad, angular and emarginate above at the suture; peristome thin, scarcely sinuate, columellar margin much curved, expanded, vertical, and more broadly reflected above.

Major diam. 10, min. 9, height 6½ mm.

Hab. Arakan Hills, west side.

Distinguished from *T. convallata* by fewer whorls, much broader sutural channel, more oblique and rounder aperture, &c. The animal is very dark in colour, and resembles *Macrochlamys* generally, but its anatomy has not been examined.

451. **Taphrospira excavata,** *Blf. P. Z. S.* 1904, ii, p. 441, pl. 25, fig. 3. Helix compluvialis, *H. & T. C. I.* 1876, pl. 88, figs. 1, 4; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 27, pt.: *nec* Nanina compluvialis, *Blf.* 1865.

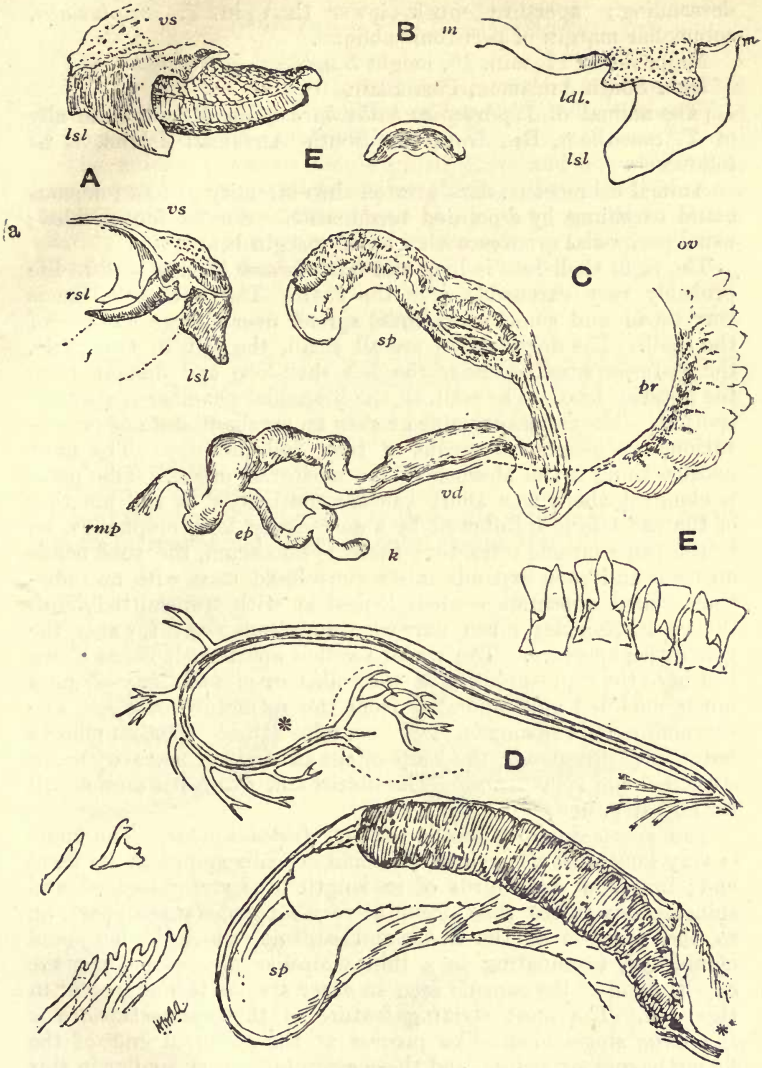
Shell similar to that of *T. compluvialis*, but larger and more globose, the microscopic longitudinal striæ on the whorls are farther apart and shallower. The aperture is large and round and the columellar margin only expanded at the perforation, the mouth is less oblique than in *T. compluvialis* and there is little or no descent of the last whorl. Whorls 5.

Major diam. 15, min. 13, height 9 mm.

Hab. North Cachar, Asalu (*Godwin-Austen*); also Khási Hills and Assam (*Nevill*).

452. **Taphrospira bathycharax,** *Bs. MS.*; *Theob. Cat.* p. 17 (no description); *Godwin-Austen, A. M. N. H.* (6) ii, 1888, p. 56; *id. P. Z. S.* 1895, p. 441; *Fulton, Jour. Mal.* x, p. 99 (1903).
Macrochlamys subconvallata, *Fulton, l. c.*

Resembles *T. compluvialis*, but is much more depressed. Shell perforate, depressed, thin, brownish horny, polished, very finely and closely longitudinally striated above and below; spire very low, suture broadly canaliculate; whorls 5–5½, the last not



[Fig. 85.—*Taphrospira bathycharax.*

A. Animal, spirit-specimen, viewed from right and left sides, showing the large left shell-lobe, the latter turned down, exposing the under surface. × 3·6.

B. The mantle-edge, with the left dorsal lobe, viewed from beneath. × 6·4.

C. Genitalia, the spermatheca containing spermatophores. × 6·4.

D. Spermatophores. × 19·2.

E. Jaw and teeth of the radula. × 368.]

descending; aperture much lower than in *T. compluvialis*, columellar margin of peristome oblique.

Major diam. 11, min. 10, height 5 mm.

Hab. South Andaman, Port Blair.

[The animal of *Taphrospira bathycharax*, Bs. MS., a close ally of *T. convallata*, Bs., from the South Andaman Island, is as follows:—

Animal ochraceous, dark grey on the extremity of foot; mucous gland overhung by a pointed termination. Sole of foot divided; usual peripodial grooves with a broad margin below.

The right shell-lobe is long and fairly broad at base, and in life probably very extensible over the shell. The left shell-lobe is very broad and smooth and must spread over a large surface of the shell. The dorsal lobes are all small, the left in two parts, the posterior situated under the left shell-lobe and distant from the anterior lobe. The wall of the branchial chamber is sparsely spotted. The animal examined was in an excellent state of preservation, the generative organs at their full maturity. The most notable thing is the absence of the amatorial organ. The penis is elongate, there is a short kalc-sac contiguous to the junction of the vas deferens, followed by a moderately long epiphallus, up to the penis muscle retractor; there is no cæcum, the tube bends on itself and soon expands into a convoluted mass with an indistinct coiled appearance when looked at with transmitted light, thence it becomes much narrower and leads away towards the generative aperture. The above swollen aperture looks as if we had here the representative of the coiled cæcum of *Macrochlamys* much modified and separated from the retractor muscle. The spermatheca is elongate, and contains three spermatophores beautifully preserved; the walls of the sac were of necessity much stretched and transparent. The uterus and ovo-testis do not call for any attention.

The spermatophore recalls that of *Austenia gigas*. The flume is very long with a bunch of fine bifid delicate spines at its basal end; for about two-thirds of its length it is straight-edged and spineless, six spines then occur at very equal distances apart, up to the junction of the flume and capsule, which is long and cylindrical, terminating in a thin whip-like appendage, but the cap-like end of the capsule seen in other species is not present in this one. The most striking feature of this spermatophore is the large single antler-like process at the terminal end of the flume, having six points, and these again bifid, very similar in this respect to *A. gigas*.

Jaw semicircular, with a central projection.

The radula formula is

$$+\ 18\ .\ 2\ .\ 9\ .\ 1\ .\ 9\ .\ 2\ .\ 18\ +$$
$$+\ 29\ .\ 1\ .\ 29\ +$$

Central tooth tricuspid, admedians bicuspid, of usual form in *Macrochlamys*.]

[Subfamily SOPHININÆ.

The single genus *Sophina*.

The form of the shell with its more or less developed umbilical keel, together with the very different type of radula, distinguishes it from the preceding subfamilies.

The animal possesses ample broad right and left shell-lobes, also a very large and entire left dorsal lobe. The radula presents teeth of similar shape throughout the row, pyramidal in shape, sharply pointed, springing from an obtusely rounded basal plate. There are 80–100 teeth in the row.]

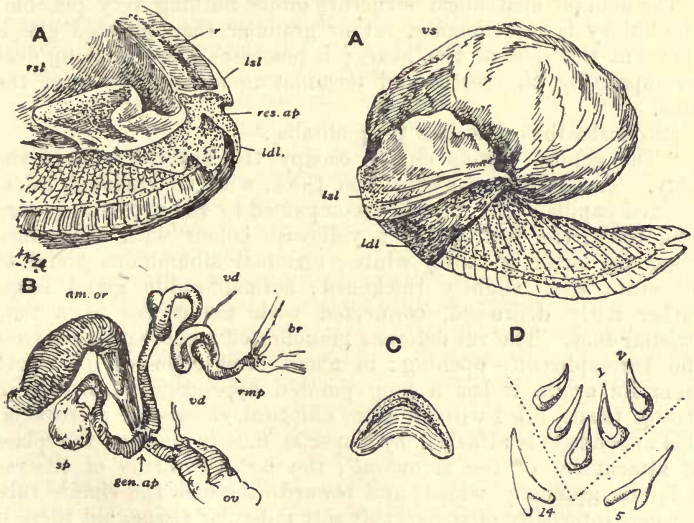
Genus **SOPHINA.**

Sophina, *Benson, A. M. N. H.* (3) iii, 1859, p. 473; *id. t. c.* (3) v, 1860, p. 26; *id. t. c.* (3) xi, 1863, p. 323; *Stoliczka, J. A. S. B.* 1871, 2, p. 252; [*Godwin-Austen, Mol. Ind.* ii, 1907, p. 221, pl. 115, figs. 5, 5 *a* (animal), pl. 116, fig. 3 (anatomy)].

Type, *S. calias*, Bs.

Range. Tenasserim Provinces.

Shell umbilicated, depressed or globosely depressed, thin, horny, generally resembling *Macrochlamys* except that the columella is



[Fig. 86.—*Sophina schistostelis.*

A. Animal viewed from the right and left sides, shell removed to show shell- and dorsal lobes. × 1·4.
B. Genitalia. × 1·4.
C. Jaw, enlarged (after Stoliczka).
D. Teeth of radula (ditto), 5th and 14th, lateral view of.]

thickened, forming a sharp angle with the basal margin of the peristome, and with a notch at the angle from which a keel runs round the umbilicus.

The animal (taken from Stoliczka's description of *S. calias*, ? *S. schistostelis*) is fully retractile within the shell. The foot is elongate, very narrow, with a distinct peripodial groove, the posterior end obliquely truncate, occupied by a large high gland, above which is a distinct horn-like appendage. The sole has two longitudinal grooves dividing it into three subequal parts, the middle rather narrower than the other two. Eye-pedicels about half the length of the body; tentacles about one-fourth the length of the eye-pedicels.

Mantle conspicuously thickened near the margin. The left shell-lobe is very large, entire, reflected over the edge of the outer lips of the shell and below considerably produced. The right lobe is divided into two parts: the upper is linguate, narrowly produced and covering the base of the shell, partially also extending on to the upper surface of the penultimate whorl, as in *Macrochlamys*; the lower portion is shorter, somewhat folded and reflected over the columellar lip. The dorsal lobes are well developed and entire. Genital opening at the upper somewhat outer base of the right eye-pedicel.

The general anatomical structure offers nothing very peculiar. The kidney is an elongate, rather granular than plicated gland, placed at the side of the heart; it possesses a special long duct accompanying the rectus and terminating a little short of the anus.

[Stoliczka thus describes the genitalia:—

"The genital organs chiefly occupy the anterior part of the body. The arrow-sac is short and thick, with an enclosed, thick, pointed papilla. The uterus, accompanied by the prostata, is very long, thick, the former has a yellowish colour with a greenish tinge, the latter is purely white; terminal albuminous gland of moderate size, slightly thickened; hermaphrodite gland large, rather flatly depressed, connected with the uterus by a long twisted duct. The vas deferens branches off a short distance from the hermaphrodite opening: in about three-fifths of its length from its origin it has a long pointed appendage, consisting of strong tissue, filled with minute, elliptical, calcareous secretions; this appendage is attached by a special muscle close to the place of attachment of the arrow-sac; the last two-fifths of the vas deferens gradually widens and towards the end the simple tube consists internally of remarkably soft muscular tissue, but there is no papilla present. The receptaculum seminis is a globular gland, attached to a long slightly twisted string, originating from the oviduct quite close to the hermaphrodite opening."

It is apparent from this description and the figure that accompanies it that these organs were not at their full state of development, and were long and string-like in appearance. Those dissected lately by me were in a much more advanced stage (see

fig. 87). The spermatheca is globular at the free end, but on a strong thick base. The vas deferens is given off from a bulbous expansion of the penis-tube close below the junction of the thick strong retractor muscle. The shaft of the male organ to the generative aperture is peculiarly long. The amatorial organ is short and thick with well-developed pointed papilla.

"The jaw of *calias* is broadly semilunar, thin, apparently smooth, but when moderately enlarged and viewed in transparent light a distinct concentric striation is perceptible, and there are some very minute radiating lines to be observed near the middle part.

"The radula is elongately quadrangular, consisting of about 35 to 50 transverse rows of teeth, meeting at sharp angles in the middle line; there are about 80–100 teeth in each row. They are all of a similar shape, pyramidal, sharply pointed and attenuated in the front, gradually becoming wider and terminating with an obtusely rounded base. The middle tooth is slightly contracted below the middle, it is symmetrical; the laterals are gradually more bent outwards on either side and possess on the outer side near the point a rounded and angular projection; the angle appears to be directed posteriorly; the outermost teeth are quite simple. The teeth of *S. discoidalis* and *conjungens* are exactly similar to those of *calias*, only comparatively smaller." (*Stoliczka.*)

The genus *Sophina* is perhaps the most interesting in the family Zonitidæ; it is the most aberrant of all I have examined. It presents departure from the ordinary type, particularly from those which the form of the shell recalls. The most striking character is the radula; there is nothing approaching the peculiar simple form of the teeth in any known genus of the family. Next, the large, broad, left dorsal lobe, entire for its whole length, without a trace of a slit. This character is that of an old Peninsular India group met with in *Ariophanta* (*Nilghiria*) *solata*, *Ariophanta tranquebarica*, and with a slight slit about halfway in *Xestina ligulata*, *basileus*, and *chenui*. The peculiar structure of the columellar margin is probably due to this mantle-lobe and the large left shell-lobe combined; the latter being tongue-like and extending far back, it would be close to and play around the umbilicus.

With regard to the distribution of *Sophina*, it is an interesting point whether it is the remnant of a genus at one period more widely spread than it is at present along the narrow belt of the Tenasserim coast, or whether it is of more recent and local development. The former seems to me to be the most likely, although there is no Indian genus at present known with which it can be linked up. It is the associate, as Stoliczka points out, writing of the physical features of Moulmein, of several very peculiar and interesting genera, which are known now to range further than when he wrote. There is a large extent of country yet to be explored to the northward, and species related to *Sophina* may be looked for on the flanks of the great gneissic backbone of the Malay Peninsula, and away into the Shan country and Upper Burma.]

[453. **Sophina calias**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 472; *id. op. cit.* (3) v, 1860, p. 26; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 112; *H. & T. C. I.* 1876, pl. 147, figs. 2, 3; *Nevill*, Nanina (Sophina) *Hand-l.* i, 1878, p. 52.

Sophina discoidalis, *Stol. J. A. S. B.* 1871, 2, p. 258, pl. 19, figs. 5, 11, 12; *Pfr.* Helix (Sophina), *Mon. Hel.* vii, 1876, p. 117; *H. & T. C. I.* 1876, pl. 147, fig. 7; *Nevill*, *Hand-l.* i, 1878, p. 52.

Sophina schistostelis, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 473; (3) v, 1860, p. 27; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. iii; *id. t. c.* vii, 1876, p. 116; *H. & T. C. I.* 1876, pl. 147, figs. 5, 6; *Nevill*, Nanina (Sophina), *Hand-l.* i, 1878, p. 52.

Sophina calias, *Stol. J. A. S. B.* 1871, 2, p. 225, pl. 19, figs. 1–4 & 7–9 (anatomy and shell).

Fig. 87, A, A'.

Shell narrowly umbilicated, depressedly orbiculate, solid, obliquely striated, pale horny; spire flat, apex slightly raised, obtuse, suture marginate; whorls 5, convex, moderately increasing, the last rounded at the circumference, below slightly convex; aperture broadly lunate, suboblique; peristome straight, acute, the columellar margin obliquely descending, thickened, slightly reflected, at base narrowly notched, extremity of notch keeled umbilicately, forming a gradual spiral receding within the narrow umbilicus.

Large species: major diam. 15, min. 13·5, alt. axis 6 mm.

Ordinary size: „ „ 9, „ 7·5, „ „ 4 „

Hab. Near Moulmein at the Farm Caves and Tavoy (*Theobald*).

The specimens from Tavoy are very solid and milky white in colour. The adult shell always shows two periods of growth, the position of the old aperture showing as a varix on the last whorl.]

[454. **Sophina schistostelis**, *Bs.* (Helix) *A. M. N. H.* (3) iii, 1859, p. 473, (3) v, 1860, p. 27; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 111; *id. t. c.* vii, 1876, p. 116; *H. & T.* (Sophina) *C. I.* 1876, pl. 147, figs. 5, 6; *Nevill*, Nanina (Sophina), *Hand-l.* i, 1878, p. 52.

Sophina calias, *Stol. J. A. S. B.* 1871, 2, p. 225, pl. 19, figs. 1–4 & 7–9 (anatomy and shell).

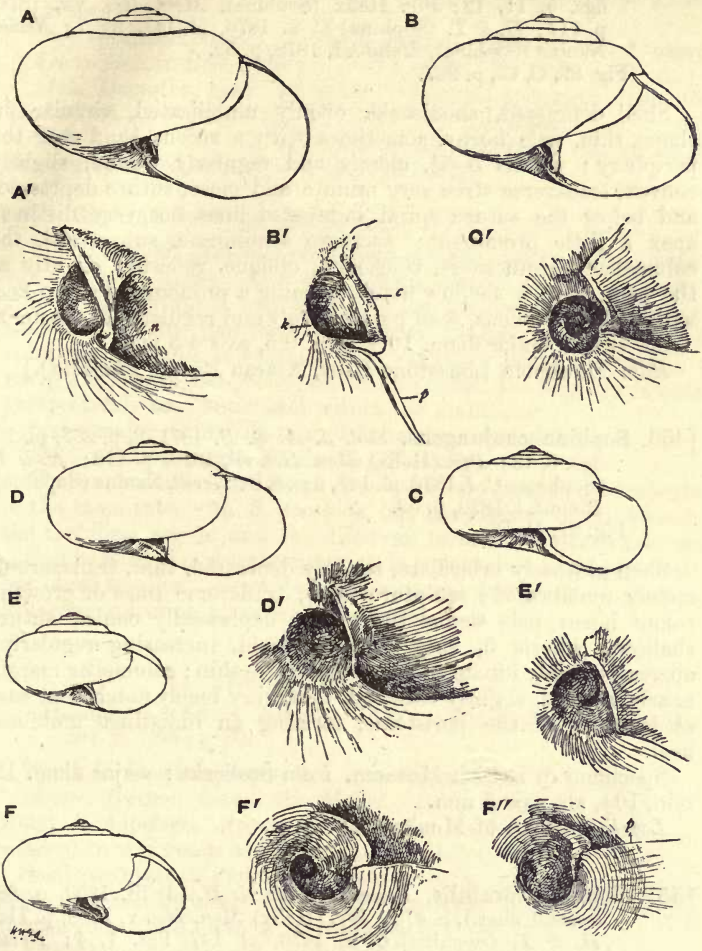
Vide fig. 86, p. 283; fig. 87, B, B'.

Shell perforate, globosely depressed, thin, smooth, irregularly transversely striate, translucent, shiny, pale horny; spire short, apex slightly elevated, obtuse, suture impressed and marginate; whorls $4\frac{1}{2}$–$5\frac{1}{2}$, above and below slightly convex, rounded on the last; aperture subrotundately lunate; peristome thin, straight; columellar margin vertical, thickened slightly, forming with the basal margin of the peristome a deep notch or cleft, compressed into a sharp keel round the umbilicus and retreating within it.

Specimen described: major diam. 16, min. 13·5, axis 8·5 mm. (Specimen described by Benson.)

Hab. Near Moulmein.

This species can be determined at once by the deep cleft, which is longer and deeper than in any other species of the genus.]



[Fig. 87.—Species of *Sophina*.

A. *Sophina calias*. × 3.
A′. Columellar margin and notch with umbilical keel of same. × 8·25.
B, B′. *Sophina schistostelis*.
C, C′. „ *discoidalis*.
D, D′. „ *conjungens*.
E, E′. „ *forabilis*, var. *bensoni*.
F, F′. „ *forabilis*.
F″. „ „ showing notch.

c, columellar margin; *p*, peristome; *k*, umbilical keel; *n*, notch.]

[455. **Sophina discoidalis**, *Stol. J. A. S. B.* 1871, 2, p. 258, pl. 19, figs. 5, 11, 12; *Pfr.* Helix (Sophina), *Mon. Hel.* vii, 1876, p. 117; *H. & T.* (Sophina) *C. I.* 1876, pl. 147, fig. 7; *Nevill*, Nanina (Sophina), *Hand-l.* i, 1878, p. 52.
Fig. 87, C, C′, p. 287.

Shell depressed, subdiscoid, openly umbilicated, circular in shape, thin, pale horny, sometimes with a rufous band near the periphery; whorls 5–5½, closely and regularly wound, slightly convex, transverse striæ very minute and close, suture depressed, and below the suture spiral impressed lines not very distinct, apex a little prominent; aperture semilunate, subvertical, the columellar margin short, thickened, oblique, reflected slightly at the base, with a shallow notch, forming a pronounced sharp keel within the umbilicus, seen perspectively and regularly to the apex.
Sp. B.M.: major diam. 10·5, min. 9·5, axis 4·5 mm.
Hab. Moulmein Limestone Hills, Ataran River (*Theobald*).]

[456. **Sophina conjungens**, *Stol. J. A. S. B.* 1871, 2, p. 257, pl. 19, figs. 6, 13; *Pfr.* (Helix) *Mon. Hel.* vii, 1876, p. 118; *H. & T.* (Sophina) *C. I.* 1876, pl. 147, figs. 8, 9; *Nevill*, Nanina (Sophina), *Hand-l.* i, 1878, p. 52.
Fig. 87, D, D′.

Shell globosely orbiculate, slightly depressed, thin, transparent, openly umbilicated; sculpture none, transverse lines of growth; colour horny pale sienna tint; spire depressedly conic; suture shallow; whorls 5, very convex, tumid, increasing regularly; aperture ovately lunate, oblique; peristome thin; columellar margin nearly vertical, slightly reflected, thin, very feebly notched at base at junction of the peristome, forming an indistinct umbilical keel.
Specimen in British Museum, from Stoliczka: major diam. 12, min. 10½, alt. axis 5 mm.
Locality. South of Moulmein.]

[457. **Sophina forabilis**, *Benson, A. M. N. H.* (3) iii, 1859, p. 389 (emend. char.), p. 473; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 112; *H. & T.* (Sophina) *C. I.* 1876, pl. 147, figs. 1, 4; *Nevill*, Nanina (Sophina), *Hand-l.* i, 1878, p. 52.
Fig. 87, F–F″.

Shell semiglobosely conoid, very openly and perspectively umbilicated, transversely striate; sculpture under high power very fine longitudinal striation on the upper whorls, beneath and around the umbilical keel the striæ become quite coarse and distant; colour horny brown; spire conoidly depressed, apex rising slightly, subobtuse; whorls 5½–6, convex, rather rapidly increasing, rounded on the periphery, aperture roundly and obliquely lunate; peristome vertical, acute; columella sinuate, somewhat thickened, at the junction with the peristome is a fold

or short close cleft forming a very sharp keel, continuous up the umbilicus.

Size specimen figured: major diam. 8, min. 7·5, alt. 4 mm.
Large spec. in Brit. Mus.: „ „ 9, „ 8·5, „ 4 „

Hab. Damotha, near Moulmein. Figured specimen from the Godwin-Austen collection: received from Stoliczka.

This species may be known from all others of this genus by the coarse spiral striation on the basal side.]

[458. **Sophina forabilis, var. bensoni.** *Vide* fig. 87, E, E'.

Shell globosely conoid, umbilicated; surface smooth, not polished; colour umber-brown; spire depressedly conoid, suture impressed; whorls 5, increasing regularly, the last two rather more rapidly, rounded on the periphery; aperture ovately lunate, oblique, columellar margin subvertical, very slightly thickened, forming a sharp angle with the peristome, but no notch, the angle continued perspectively as a blunt keel within the umbilicus.

Size: major diam. 7·5, min. 6·5, height axis 4 mm.

Hab. Damotha, near Moulmein (*Stoliczka*).

Three specimens of this shell received by me from Ferd. Stoliczka in the same tube with *S. forabilis*, but the absence of striation in the umbilical region and the different form of umbilical keel are sufficient to distinguish the species. It is very close to *S. conjungens*, but much smaller. Several examples named *forabilis* in the British Museum collection agree with this form.]

Genus **HEMIPLECTA.**

Hemiplecta, *Albers, Heliceen*, 1850, p. 60; *Godwin-Austen, Mol. Ind.* ii, 1898, p. 70.

Type, *H. humphreysiana*, Lea, from Singapore. [Fig. 88, A–D.]

Range. Burma, Siam, the Malay Peninsula and part of the Malay Archipelago. Species from the peninsula of India formerly referred to this genus are now known to belong to *Ariophanta*.

Shell perforate or umbilicated, subterminate or depressed, rather solid; whorls regularly increasing; aperture lunate; peristome obtuse, sometimes more or less thickened.

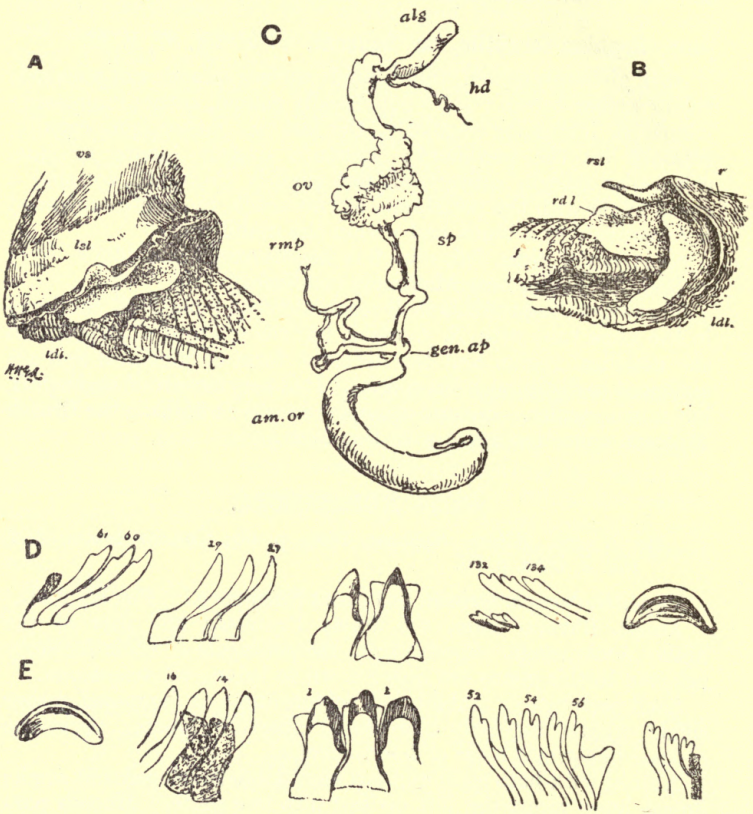
Animal with both right and left shell-lobes developed, but small; dorsal lobes large, the left divided into two parts. Mucous pore large, sometimes with an overhanging lobe above. Foot divided longitudinally beneath.

In the generative organs the dart-sac is very large and cylindrical, the spermatheca small and pear-shaped; the retracted muscle of the penis attached at about two-thirds of the length from the distal extremity to the junction of the vas deferens, without any free cæcum. No kalc-sac.

Radula long and broad, with many teeth in a row. In *H. humphreysiana* Godwin-Austen found 163 rows, each containing 125 . 2 . 20 . 1 . 20 . 2 . 125 (147 . 1 . 147) teeth. The

median and admedian are almost triangular, without distinct lateral cusps. The outer laterals are unicuspid at first, but soon become bicuspid and towards the margin are small and narrow.

As the animals of the Burmese forms referred to *Hemiplecta*, with the exception of *H. uter*, are imperfectly known or unknown, it is doubtful whether all belong to the present genus.



[Fig. 88.—*Hemiplecta humphreysiana.*

A. Animal, spirit-specimen, viewed from left side. × 1·8.
B. Ditto, ditto, viewed from the anterior and lower side. × 1·8.
C. Genitalia, natural size.
D. Teeth of the radula, × 276; jaw, × 6.

Hemiplecta uter.

E. Teeth of the radula, × 276; jaw, × 6.]

A. *Subturbinate.*

459. **Hemiplecta uter**, *Theobald* (Helix), *J. A. S. B.* xxviii, 1859, p. 305; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 227; *H. & T.* (Helix) *C. I.* 1876, pl. 50, figs. 7, 8; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 30; *Godwin-Austen, Mol. Ind.* ii, 1898, p. 77, pl. 82, figs. 1–1 *d* (radula).
[Fig. 88, E.]

Shell openly perforate, depressedly turbinate, thin, yellowish white, ornamented with lines of growth obliquely crossed by small flexuous irregular ridges and furrows, which disappear a little below the periphery, the lower surface being smooth and finely decussated; spire conoidal, apex acute, suture impressed; whorls 5, slightly convex above, the last scarcely descending, keeled at the periphery, rounded below; aperture oblique, roundly lunate, about as broad as high; peristome thin, straight, columellar margin vertical above and triangularly reflected.

Major diam. 27, min. 24, height 17 mm.

Hab. Near Moulmein and hills west of Toungoo (*Theobald*).

Animal with a very small lobe above the mucous pore. Small shell-lobes to mantle. Teeth of radula similar to those of *H. humphreysiana*: 77 . 38 . 10 . 1 . 10 . 38 . 77 (125 . 1 . 125).

B. *Depressed.*

460. **Hemiplecta undosa**, *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 68; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 161; *H. & T.* (Helix) *C. I.* 1876, pl. 3, figs. 2, 3; *Nevill*, Nanina (Hemiplecta), *Hand-l.* i, 1878, p. 47.

Shell rather narrowly umbilicated, conoidly depressed, rather solid, whitish, in dead shells marked above by oblique striæ, crossed by irregular series of close spiral (longitudinal) impressed lines, smoother beneath, the concentric lines becoming fainter below the periphery; spire low, conoid, apex obtuse, suture impressed; whorls 5, rather rapidly increasing, convex above, the last broader, subangulate at the periphery, rounded beneath; aperture diagonal, roundly lunate, as broad as high; peristome simple, straight, columellar margin oblique, slightly carried forward and reflected above.

Major diam. 36, min. 31, height 21 mm.

Hab. Shan Hills, east of Mandalay, Burma.

This species somewhat resembles the Singapore *H. humphreysiana* in form and sculpture. Only dead decorticated specimens were originally obtained, but fresh shells may have a yellowish or brownish epidermis. Hanley's figure represents a shell with strong oblique sculpture, a distinct keel at the periphery, and yellowish in colour, and may represent a distinct species or variety.

H. zimmayensis, Godwin-Austen, P. Z. S. 1888, p. 241, from Zimmé (Chieng Mai) in Siam, is a large umber-brown species, $2\frac{1}{2}$

inches in diameter, and allied to the common Siamese *Hemiplecta distincta*, Pfr., of which it may be a variety. No specimens have hitherto been obtained within British territory in Tenasserim, but it is not improbable that, like other Siamese shells, it may be found.

461. **Hemiplecta? textrina**, *Bs.* (Helix) *A. M. N. H.* (2) xviii, 1866, p. 252; *Pfr.* (Helix) *Mon. Hel.* iv, 1859, p. 58; *Blf.* (Nanina) *J. A. S. B.* 1865, 2, p. 87; *H. & T.* (Helix) *C. I.* 1876, pl. 52, figs. 2, 5; *Nevill* (Nanina), *Hand-l.* i, 1878, p. 32; *Godwin-Austen* (Macrochlamys), *Mol. Ind.* i. 1883, pl. 21, fig. 37 (sculpture).

Shell perforate, depressed to conoidly depressed, rather thin, pale rufescent to whitish horny, the whorls transversely striated above and decussated with fine impressed spiral lines, smoother beneath, and the decussating lines gradually disappearing on the base towards the perforation; spire varying from very low to depressedly conoid, suture slightly impressed; whorls $5\frac{1}{2}$–$6\frac{1}{2}$, flattish, gradually increasing, the last varying from subangulate to distinctly angulate at the periphery, generally slightly angulate, convex beneath; aperture slightly oblique, broadly lunate; peristome obtuse, slightly thickened and opaque white inside; basal margin almost straight, slightly arcuate, columellar short, sinuate, oblique, moderately reflected above.

Major diam. 29, min. 25, axis 15 mm.

Hab. Western Pegu and Arakan as far north as Akyab.

The animal has a small lobe above the mucous caudal gland, and the foot is flatter than in *Macrochlamys*. Colour light grey; genitalia and radula undescribed.

A large shell measures 36, 31, and 18 mm., a small one, with the spire higher than usual, 25, 22, and $14\frac{1}{2}$. Shells from the neighbourhood of Thayetmyo and Prome have the periphery much less angulate than those from Bassein.

This species and *H. theodori* may possibly belong to *Macrochlamys*, but they are more probably members of the present genus or nearly allied to it.

462. **Hemiplecta theodori**, *Phil.* (Helix) *Zeitschr. Mal.* 1846, p. 191; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 70; *id. t. c.* vii, 1876, p. 122; *H. & T.* (Helix) *C. I.* 1876, pl. 59, figs. 7, 8.

Shell openly perforate, depressed, sublenticular, pale yellowish tawny, rather thin, subcostulately striated, the striæ decussated by spiral (longitudinal) impressed lines; spire low, apex obtuse, suture impressed; whorls 6–$6\frac{1}{2}$, convex above, the last bluntly angulate at the periphery, descending near the mouth in adults, moderately tumid beneath; aperture oblique, almost diagonal, broadly lunate; peristome white, slightly thickened inside, outer margin broadly sinuate, columellar curved, oblique, briefly reflected above.

Major diam. (of adult from Ataran) $26\frac{1}{2}$, min. 24, height

13 mm. Another specimen measures $24 \times 21 \times 10\frac{1}{4}$; an immature shell from Mergui $27 \times 23\frac{1}{2} \times 13$.

Hab. Mergui (*Philippi*), Yanglaw, Tenasserim valley; Ataran Valley (*Theobald*); top of Muleyit (*Fea*).

The type described by Philippi appears to have been immature, as was certainly the shell figured by Pfeiffer in Mart. & Chemn. Conch.-Cab. 2nd ed. no. 687, pl. 110, figs. 1–3. The two specimens obtained by Theobald from Ataran, now in the British Museum, are probably the first adult shells described.

This species is distinguished from *H. textrina* by much coarser sculpture, descending last whorl, and more oblique and small aperture.

463. **Hemiplecta? gordoniæ**, *Bs.* (Helix) *A. M. N. H.* (3) xi, 1863, p. 87; *Pfr.* (Helix) *Mon. Hel.* v, 1868, p. 402; *H. & T.* (Helix) *C. I.* 1876, pl. 27, fig. 42.

Shell perforate, orbiculate, depressed, rather thin, whitish, above obliquely striated on inner whorls, plicate on outer whorls, beneath smooth, radiately striated, and decussated by subdistant concentric impressed lines; spire almost flat, apex slightly raised, obtuse, suture impressed; whorls 7, slowly increasing, slightly convex, outer whorls concave outside near suture, the last sharply and compressedly keeled, not descending; aperture nearly vertical, broad, angularly lunate; peristome obtuse, white, slightly thickened inside, basal margin arcuate, columellar short, slightly reflected at perforation.

Major diam. 33, min. 30, axis 11 mm.

Hab. Nidoung Toung, Ataran Valley, near Moulmein.

The affinities of this species are very doubtful, and it may belong to the Helicidæ.

464. **Hemiplecta? auriettæ**, *Tapp. Canefri*, Nanina (Macrochlamys), *Ann. Mus. Civ. Gen.* xxvii, 1889, p. 318, pl. 8, figs. 4, 5, 6.

Shell narrowly umbilicated, suborbiculately depressed, subangulate at the periphery, rather thin, closely and strongly decussated above, silky, olivaceous, glossy beneath, paler, and radiately striated; spire but little raised, apex obtuse; whorls $6\frac{1}{2}$, slowly increasing, the last not descending, slightly flattened at the base; aperture slightly oblique, regularly ovately lunate; peristome simple, acute, margins remote, columellar oblique, briefly reflected over the umbilicus above at its insertion.

Major diam. 24, min. 21, height $10\frac{1}{2}$ mm.

Hab. Muleyit, Tenasserim, at about 6000 feet elevation (*Fea, Beddome*).

The suture is lightly impressed and not as represented in the figure. The sculpture resembles that of *Euplecta indica*.

The affinities of the species are doubtful; it may belong to the Helicidæ.

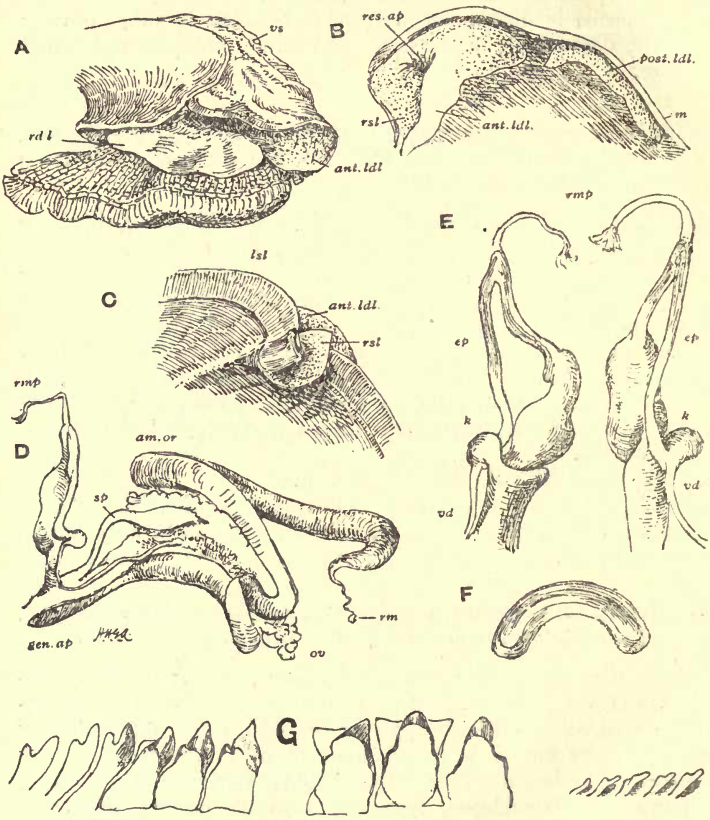
Genus **HAUGHTONIA.**

Subgenus Haughtonia, *Godwin-Austen, Mol. Ind.* ii. 1899, p. 120.

Type, *H. conferta*, Pfr.

Range. The Andaman Islands.

Shell perforate, subglobose, rather solid, with a thick epidermis and distinct spiral striation; whorls about 5; aperture oblique;



[Fig. 89.—*Haughtonia conferta.*

A. Animal, viewed from the right side. × 1·7.
B. The mantle-edge and dorsal lobes detached. × 1·5.
C. The mantle-edge in vicinity of the respiratory orifice, showing the rudimentary right shell-lobe. × 6·8.
D. Genitalia. × 1·9.
E. The male organ, from two different sides. × 1·4.
F. The jaw. × 6.
G. Teeth of the radula. × 182.]

peristome straight, in one plane, slightly thickened within, columellar margin with a small tooth-like swelling.

Animal with a short foot behind, the sole not divided, mucous pore large, no overhanging lobe. Right shell-lobe rudimentary, left wanting, anterior left dorsal lobe distinctly separate from the posterior. Male organ bent on itself, to which bend the retractor muscle is attached, a long tube connecting this bend with the small globose kalc-sac; penis distally to the bend forming a short tube leading to a swollen bulbous portion, to which succeeds a short broad sheath adjoining the genital aperture. Dart-sac or amatorial organ long and cylindrical; spermatheca small, pear-shaped, on a stalk.

Radula with a broad median row of large teeth, somewhat as in *Hemiplecta densa*, but with fewer outer laterals:

21 . 2 . 20 . 1 . 20 . 2 . 21 (43 . 1 . 43)

Median tooth almost straight-sided, with only an indication of lateral cusps; inner laterals without inner cusps and with outer cusps slightly developed, outer laterals bicuspid.

This genus differs from *Hemiplecta* in the foot not being divided beneath, in the want of shell-lobes, the characters of the male organ, and the much less numerous lateral teeth on the radula. The shell recalls certain Seychelle and Mascarene species (*Stylodon unidentata*, *Erepta stylodon*), but the animals do not appear to have been described.

465. **Haughtonia conferta**, *Pfr.* (Helix) *P. Z. S.* 1856, p. 328; *id. Mon. Hel.* iv, 1859, p. 183; *Godwin-Austen* (Rhyssota), *J. A. S. B.* 1882, 2, p. 70, pl. 5, fig. 6 (animal); *id.* Helix (Rhysota), *P. Z. S.* 1895, p. 442; *id. Mol. Ind.* ii, 1899, p. 120, pl. 99, figs. 1–8 (animal and anatomy).

Helix haughtoni, *Bs. A. M. N. H.* (3) xi, 1863, p. 87; *Pfr. Mon. Hel.* v, 1868, p. 92; *H. & T. C. I.* 1876, pl. 28, fig. 3; *Stol. J. A. S. B.* 1870, p. 87; *Nevill*, Nanina (Rhyssota), *Hand-l.* i, 1878, p. 46.

Rhyssota chambertinii, *Tryon*, *Am. Jour. Conch.* v, 1869, p. 109, pl. 19, fig. 2.

Shell perforate, subumbilicate, depressedly conoidal, subturbinate, solid, whitish with a thick yellowish-brown epidermis, sculptured with oblique lines of growth and fine, close, flexuous spiral striæ above and below; spire conoidal, apex obtuse, suture impressed; whorls 5, slightly convex above, the last flatter, angulate at the periphery, rounded beneath, compressed around the umbilicus; aperture diagonal, roundly lunate, subquadrangular; peristome in one plane, obtuse, slightly thickened inside, the columellar margin oblique throughout, thickened and bearing a small tooth in towards the base, briefly reflected above.

Major diam. 34, min. 29, height 19 mm.

Hab. South Andaman Island, Mount Harriet, living on the ground.

[" Animal dark brown, reddish at the pedicles. Mantle thick, greyish brown, freckled with white; body very rough; pedal row very distinct and the elongated tubercles whitish, basal edge pale greyish brown. Tail-gland distinct, surrounded by a swollen edge." (*Stoliczka*, attached to his drawing of the animal.)]

[Genus **STAFFORDIA.**

Staffordia, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 184.

Type, *S. daflaensis*, Godwin-Austen.

Range. Dafla Hills.

Animal. Foot pointed, no gland, peripodial margin simple with a narrow pale margin; right and left shell-lobes present, both small. Generative organs: dart-sac small, globose, with a long cord-like attachment to the coronal gland; penis simple; spermatheca long. Radula with aculeate laterals.

The Dafla Hills, in which this very aberrant mollusk was found, lie on and north of lat. 27° and between long. 93° 10′ and 93° 50′, at the base of the Eastern Himalaya. Nothing like it has been as yet found in any part of India or Burma.

The shell of this species is an instance of how shell-character may be misleading in classification. So like is it to many species of true *Macrochlamys*, any conchologist would place it in that genus.

In a paper on the Helicidæ (Zonitidæ) collected during the expedition into the Dafla Hills, Assam (Journ. Asiat. Soc. Bengal, vol. xlv, pt. 2, 1876), occurs the first notice of the type species.]

[466. **Staffordia daflaensis**, *Godwin-Austen.*

Helix lubrica, *Bs.*?; *Godwin-Austen, J. A. S. B.* xlv, 2, 1876, p. 311, pl. 8, fig. 9; *id.* (Macrochlamys) *Mol. Ind.* i, 1883, pl. 21, fig. 6 (sculpture); *id. t. c.* ii, 1907, p. 185, pl. 113, figs. 1–1 *i*.

Macrochlamys shengorensis, *Godwin-Austen, Mol. Ind.* i, 1883, p. 102, pl. 22, fig. 5 (young shell).

Original description:—Shell depressedly tumidly conoid, umbilicated, solid, rather flat on base. Sculpture very regular, longitudinal, sharply defined, broad-ridged ribbing. Colour rich olivaceous with ochre tint. Spire low, sides convex. Suture shallow, adpressed. Whorls 6, rapidly increasing, the last rounded; aperture broadly ovate, oblique, milky white within; peristome acute, sinuous above and slightly so below, much reflected at umbilical margin; columellar margin very oblique and descending.

	Major diam.	Minor diam.	Alt. axis.	Alt. b.-w.
Largest size:	23·5	20·0	9·4	7·8 mm.
Smaller size:	18·8	16·2	8·0	5·8 „

Hab. Shengorh Peak, Dafla Hills, 7000 ft. (*Godwin-Austen*).

It was an abundant species in the Dafla Hills, varying much in colour and size, often being of a pale ochraceous-grey tint. On Toruputu Peak it occurred also with the same characteristic sculpture, but thinner in structure.

"*Animal.* Fore part of foot and head, as well as the tentacles, dark slate; extremity of foot pointed (no gland visible, fig. 90, B), pale grey, edged light fleshy; sole of foot dark orange; mantle very slightly reflected in front, with no tongue-shaped process.

"Length 2·0"; tentacles 0·5"; shell, major diam. 0·95"."

[Fig. 90.—*Staffordia daflaensis.*

A. Animal from right side, showing the right dorsal lobe. × 3·4.
A'. Animal from left side, the left dorsal lobe and part of the branchial wall removed, showing the male organ and position of its retractor muscle attachment. × 3·4.
B. Head and extremity of foot, from drawings from life.
C. Extremity of foot, from spirit-specimen. × 3·4.
D. Jaw, × 9, and teeth of radula, × 270.
E. Generative organs, × 3·5. *cor.gld.*, coronal gland; *d*, dart.
E'. Do. × 3·5. First specimen dissected.]

The only part of this original description which was wrong relates to the tongue-shaped process or *shell-lobes*: these were seen to be present in the second specimen soaked out; they are small, particularly the right, and might easily be overlooked in life. This had clearly a pointed foot, not divided below as in *Macrochlamys*, with an indistinct central fold, no peripodial grooves, very dark grey, a rather smooth surface with a pale narrow peripodial border.

From the two soaked-out specimens I have been able to make out much more of the genitalia than the first alone presented, which was incomplete (fig. 90, E').

The generative organs are most interesting and fall in with the dissimilarity to Zonitoid genera, such as *Macrochlamys*, presented in the external characters. They are altogether different from any species of Indian Land Mollusca I have hitherto seen, particularly in the form of the dart-sac. The penis is a simple tube bent on itself near the short retractor muscle. The spermatheca is long and ample. The oviduct in both cases was destroyed, but in the second specimen the junction of the vas deferens was intact. The dart-sac is short, rounded at the distal end, and on being opened out a blunt leathery solid dart was disclosed. Attached to the head of the dart-sac at its central point is a tube of great length: in the first specimen this is thin at first, then swelling out much larger in several coils, and again becoming thinner; in the second specimen this rope-like tube is more uniform in size, much coiled together where it is attached to a glandular mass, this was much broken up, but a large portion was seen enveloping a part of the spermatheca.

This long rope-like attachment to the dart-sac, which in the first specimen had no attachment, left very much that was doubtful as to what it could be; the second specimen clears this up, and we are presented with an amatorial organ similar in its main points to that met with in the genus *Dyakia*, particularly in that of *D. striata* var., described by me in the 'Proceedings of the Malacological Society,' vol. vii, pt. 2, June 1906. This is an extremely interesting point of resemblance—confined to one organ, and yet not shared in by several important characters. In *Dyakia* there is a large mucous pore, and the peripodial margin is fringed as in the Zonitidæ generally. There are no shell-lobes either. There are minor details in the genitalia which may be noted: the spermatheca in *Dyakia* is very small, the dart is calcareous. The radula is of the same type in both, the laterals being aculeate. The penis in both is of the same simple type. The radula of the Dafla form has 98 rows of teeth and the formula

$$\begin{matrix} 55 \,.\, 1 \,.\, 12 \,.\, 1 \,.\, 12 \,.\, 1 \,.\, 55 \\ 68 \,.\, 1 \,.\, 68 \end{matrix}$$

The centre tooth is tricuspid, the admedians also tricuspid, the inner cusp high up, the outer one lower down; the 13th tooth

has no notch. All the laterals are shortish aculeate teeth, becoming very small on the margin.

The jaw is large, solid, convex on the edge, and rather straight in the centre as opposed to the usual central projection.]

[467. **Staffordia daflaensis**, var., *Godwin-Austen, Mol. Ind.* ii, 1907, p. 185, pl. 113, fig. 2 (shell).

Original description :—Shell: sculpture coarse longitudinal ribbing, rather irregular; colour ochraceous olive-green.

Size: maj. diam. 16·4, min. 14·8; alt. axis 8·0, alt. b.-w. 6·5 mm.]

[468. **Staffordia toruputuensis**, *Godwin-Austen, Mol. Ind.* ii, 1907, p. 185, pl. 113, fig. 3 (shell).

Original description:—Shell not fully grown; sculpture very smooth, with a thick shining epidermis with indistinct striation; colour light ochraceous olive-green.

Size: maj. diam. 16·5, min. 14·0; alt. axis 7·25 mm.

Hab. Toruputu Peak, Dafla Hills.]

[469. **Staffordia staffordi**, *Godwin-Austen, Mol. Ind.* i, 1883, pl. 21, fig. 14 (sculpture); *id. t. c.* ii, 1907, p. 185, pl. 113, fig. 4 (shell).

Original description:—Shell: umbilicus almost hidden, moderately solid, with a thick epidermis, very globosely conoid, rounded below; sculpture small, elongate papillæ arranged longitudinally, and differing from all the other species collected in the Dafla Hills; colour olivaceous ochre; spire low; suture shallow; whorls 5, sides convex above, rather flattened on the periphery of the last whorl; aperture lunate, narrow, subvertical, milky white within, rounded below; peristome thin, slightly sinuate below, and nearly vertical near the columella.

Size: maj. diam. 15·2, min. 13·2; alt. axis 7·8, alt. b.-w. 6·0 mm.

Hab. Toruputu Peak, Dafla Hills, 7000 ft.

The shell is not adult, but the sculpture is so peculiar I have been obliged to designate the species, which I have named after the Brigadier-General who commanded the Expedition.]

Genus **DYAKIA.**

Dyakia, *Godwin-Austen, P. Z. S.* 1891, p. 29, pl. 5, figs. 4–4*c*, 5–5*b* (generative organs).

Semperia, *Godwin-Austen, Mol. Ind.* ii, 1898, p. 82.

Type, *D. hugonis*, Pfr., from Borneo.

Range. From Tenasserim throughout the greater part of the Malay Archipelago.

This genus is chiefly distinguished from *Ariophanta* by the characters of the radula, and especially by having bicuspid

marginals, each with two subequal points. The central tooth is either tricuspid with large lateral cusps close to the apex, or devoid of lateral cusps. Lateral teeth bicuspid. In a specimen of *D. retrorsa* there were on each side 12 inner lateral teeth and 45 marginals. The jaw had no inner median projection.

[The generative organs, as shown in the type, are peculiar, the amatorial organ having a bunch of secretory glands at the free end and a long slender calcareous dart.]

470. **Dyakia? retrorsa,** *Gould* (Helix), *Bost. Jour. N. H.* iv, 1844, p. 455, pl. 24, fig. 4; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 76; *id. t. c.* vii, 1876, p. 128; *H. & T.* (Helix) *C. I.* 1876, pl. 25, fig. 6; *Godwin-Austen* (Ariophanta), *Mol. Ind.* i, 1883, pp. 133, 136, pl. 34, figs. 4–8; *id.* (Semperia) *t. c.* ii, 1898, p. 82; *v. Mart.* Nanina (Hemiplecta), *Jour. Linn. Soc.* xxi, 1889, p. 161.

Helix saccata, *Pfr. P. Z. S.* 1854, p. 49; *id. Mon. Hel.* iv, 1859, p. 30; *id. t. c.* vii, 1876, p. 96; *Godwin-Austen, J. A. S. B.* 1880, 2, p. 153.

Shell sinistral, narrowly umbilicated, thin, obliquely striated and marked, on the last whorl especially, above and below, with fine spiral, slightly undulating wrinkles; spire conoidal, with an acute apex, suture emarginate; whorls $2\frac{1}{2}$, rapidly increasing, flatly convex above, the last compressedly keeled at the periphery, swollen beneath, not descending; aperture diagonal, ovally lunate; peristome thin.

Major diam. 45, min. 36, height 23 mm,

Hab. Tenasserim; Tavoy and Mergui; Mergui Archipelago.

[The generative organs of *D.*? *retrorsa* have not yet been examined, and it is to be seen whether they conform to the sinistral type species (*D. hugonis* of Borneo) or not.]

[Dr. Blanford's manuscript included the genera *Parmacella* and *Vitrina*, both of which I consider will be better brought into the volume on the Helicidæ, and after *Trochomorpha*, which I trust may follow next in the 'Fauna of British India' (Mollusca). In the genus *Vitrina* are included three species: *pellucida*, a typical species, and two others which cannot be said to be so, viz. *papillaspira*, Godwin-Austen, from the Khasi Hills, and *canefrii*= *birmanica*, Tapparone Canefri; it was this naturalist who considered a species obtained by M. Fea at Bhamo to be the same as *Austenia papillaspira*. I would call attention to the fact that the Bhamo shell was never compared with the type in my collection, and that it is by no means certain the animals are alike, that of the Khasi form being unknown, while the Bhamo species is described as having no mucous pore, and for this reason alone

it was placed in *Vitrina*. For the present, and until more is known of the Khasi Hill species, it is safer to place it in the genus *Cryptaustenia*, after No. 286, p. 188.

I cannot believe these tropical forms are related to, or that their anatomy is comparable with, that of the Palæarctic genus *Vitrina*, on the ground of a single character, viz. a pointed foot.

William Theobald (J. A. S. B. 1870, p. 401) describes a *Vitrina ataranensis* from the river of that name in Martaban and which Nevill placed, I think rightly as far as the knowledge we possess, in the genus *Vitrinopsis* of Semper, Hand-l. i, p. 17. I have a single specimen of this species received from Theobald, of which I have made a drawing. It has a long very pointed foot, and apparently no mucous gland; but as in some of these forms the foot tapers to an overhanging lobe, very much concealing the slit of the mucous gland below, it is very difficult in a badly-preserved hardened spirit-specimen to tell whether a mucous pore is present or not: *ataranensis* has ample right and left shell-lobes. This being the only specimen known, except the single one in the Calcutta Museum, I have not attempted to cut it up.]

APPENDIX.

To follow No. 286, p. 188:—

286 *a*. **Cryptaustenia? papillaspira**, *Godwin-Austen* (Austenia), *Mol. Ind.* i, p. 153, pl. 37, figs. 4–4 *b* (1883); *G. Tapp. Canefri* (Helicarion), *Ann. Mus. Civ. Gen.* xxvii, p. 316 (1889).

Shell depressedly subglobose, very thin, transparent, smooth, polished, light horny; spire scarcely raised, but apex prominent, nipple-shaped, suture slightly impressed; whorls 3, convex; aperture oblique, lunately oval, margins converging, upper arcuate, columellar broadly sinuate.

Major diam. 10½, min. 8, height 5½ mm.

Hab. North Khasi Hills (*Godwin-Austen*); Bhamo (*Fea*).

This differs from allied forms in the raised prominent apex.

According to Signor Canefri, this has no mucous pore, but the tail ends in a point. The animal jumps about when disturbed, as *salius* does.

*286 *b*. **Cryptaustenia? canefrii.**

Vitrina birmanica, *Tapparone Canefri, Ann. Mus. Civ. Gen.* xxvii, p. 316 (1889), *nec Philippi.*

"Shell imperforate, globose, thin, pellucid, very polished, pale amber; apex slightly exserted, obtuse; whorls 4, irregularly

wound, the last large, globose, all separated by a deep suture and an impressed serrulate line; surface smooth, marked by striæ and obsolete waved furrows throughout its length; aperture round, lunate, broad, columellar margin incurved, slightly reflexed at the base.

"Major diam. 10, min. $7\frac{2}{3}$ mm.

"Animal blackish grey above, anterior lobes with black lines; sole of foot pale, often divided by a paler median zone." (*T. Canefri*, in Latin.)

Hab. Near Bhamo.

[The next two species were included in *Macrochlamys* by Blanford. I place them here because *planiuscula* certainly is more likely to belong to the Helicidæ. Until the animals are examined it is impossible to know what their affinities are.]

Depressed or conoidly depressed.

Longitudinally striated.

Macrochlamys? anonæ, *Godwin-Austen, Mol. Ind.* i, 1883, p. 91, pl. 14, fig. 8; ii, 1898, p. 48.

Shell openly perforate, subumbilicate, convexly depressed, rather solid, finely striated longitudinally under the microscope, yellowish brown; spire convex, suture slightly impressed; whorls $3\frac{1}{2}$, convex, the last rounded at the periphery and moderately convex beneath; aperture oblique, lunate; peristome obtuse, columellar margin oblique.

Major diam. 11, height 0·6 mm.

Hab. Calcutta; found on custard-apples.

The description is from the types in the British Museum (Godwin-Austen collection). It is possible that they are immature.

Shells not exceeding about 6 millimetres (a quarter of an inch) in diameter. (Generic affinities often doubtful.)

Subglobose or subturbinate.

Smooth.

Macrochlamys? planiuscula, *Hutton* (Helix), *J. A. S. B.* vii, 1838, p. 218; *Pfr.* (Helix) *Mon. Hel.* i, 1848, p. 60; *H. & T.* (Helix) *C. I.* 1876, pl. 32, figs. 7, 10; *Godwin-Austen, Mol. Ind.* i, 1883, p. 88, pl. 16, fig. 7.

Shell obtectly perforate, subglobosely depressed, smooth, without sculpture of any kind, translucent, scarcely polished above, more

so beneath, light brown; spire convexly conoidal, suture slightly impressed; whorls $4\frac{1}{2}$, convex, slowly increasing, the last rounded at periphery, tumid beneath; aperture subvertical, lunate; peristome thin, basal margin arcuate, columellar oblique, reflected, covering the perforation.

Major diam. 2·5, min. 2·3, height 1·5 mm.

Hab. Simla, Landour, Mussoorie, amongst dead leaves (*Godwin-Austen*).

The description is taken from a Mussoorie specimen.

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